

[illegible]

Fig. 1

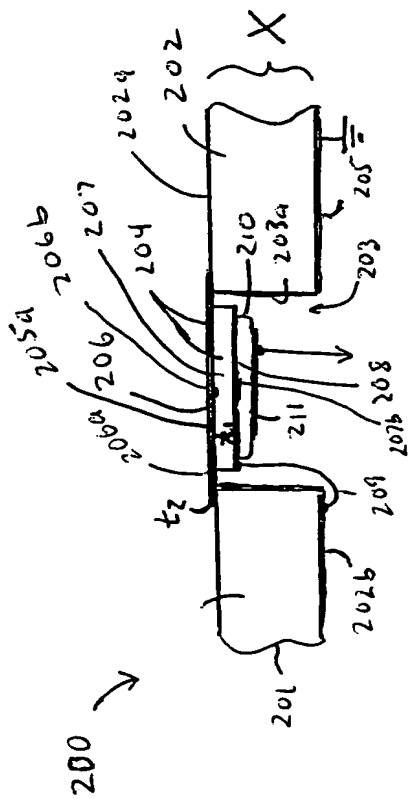


FIG. 2

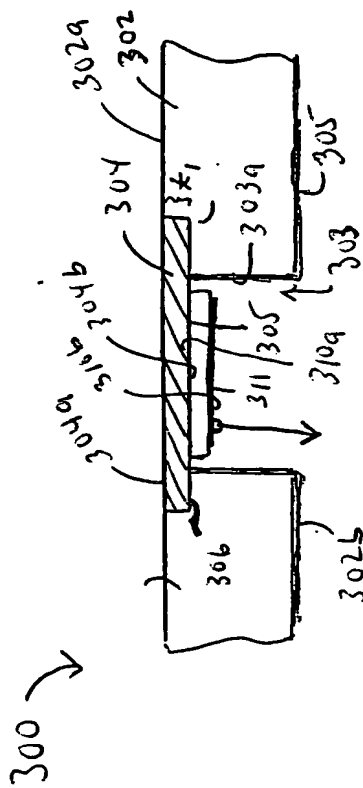


FIG. 3

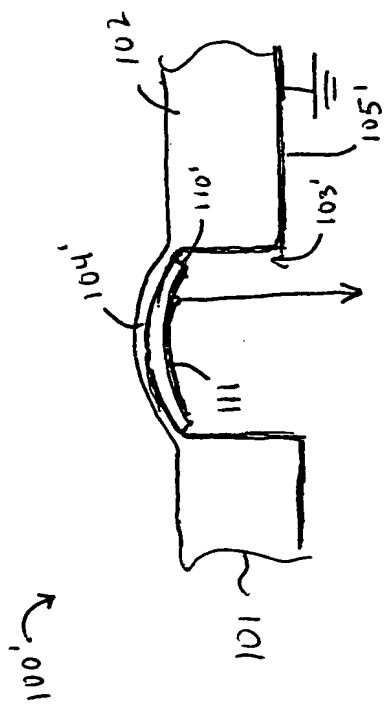


FIG. 4

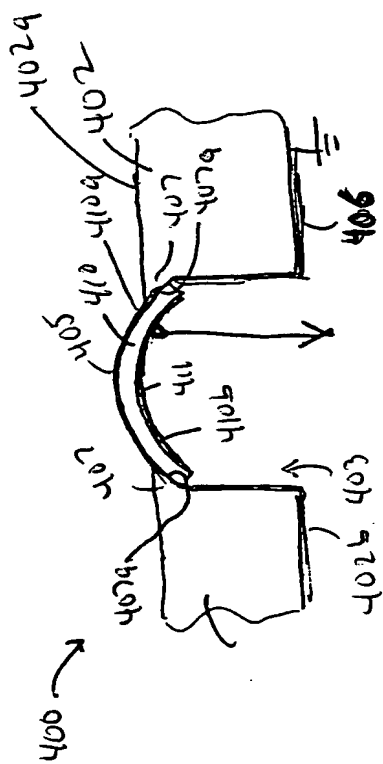


FIG. 5

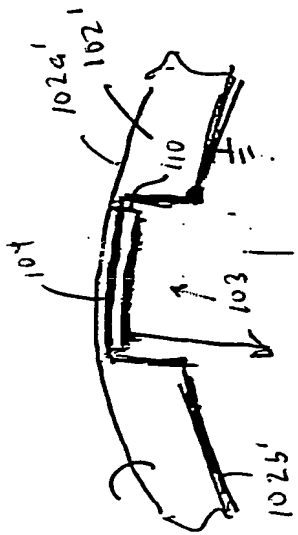
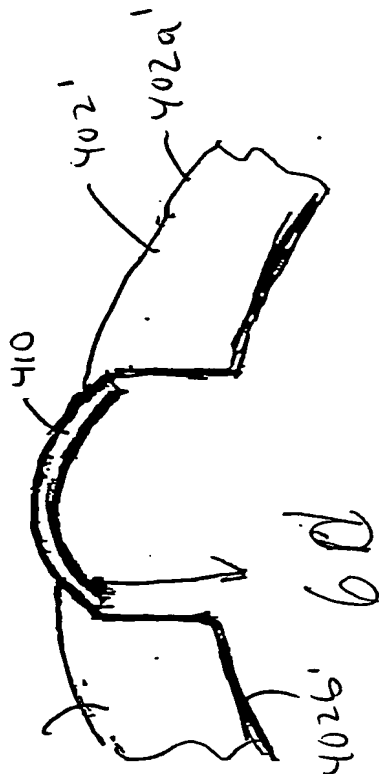
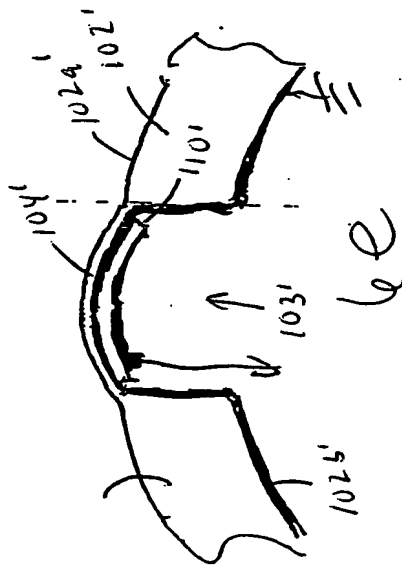
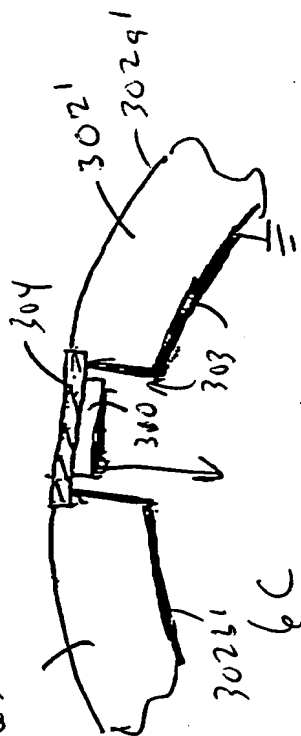
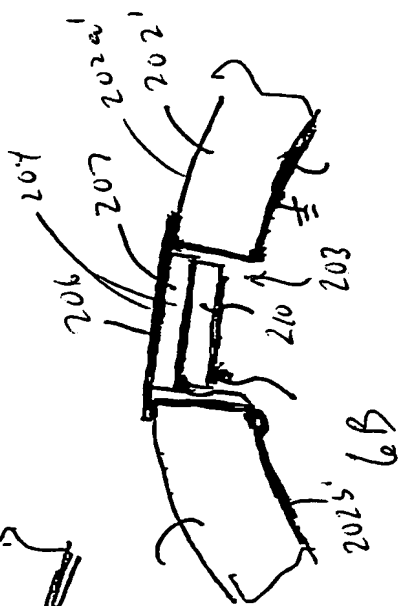
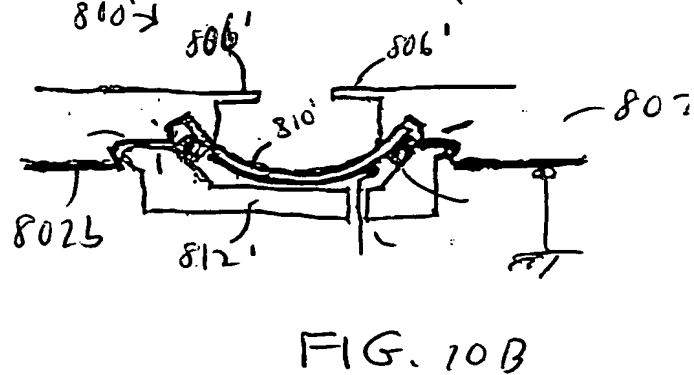
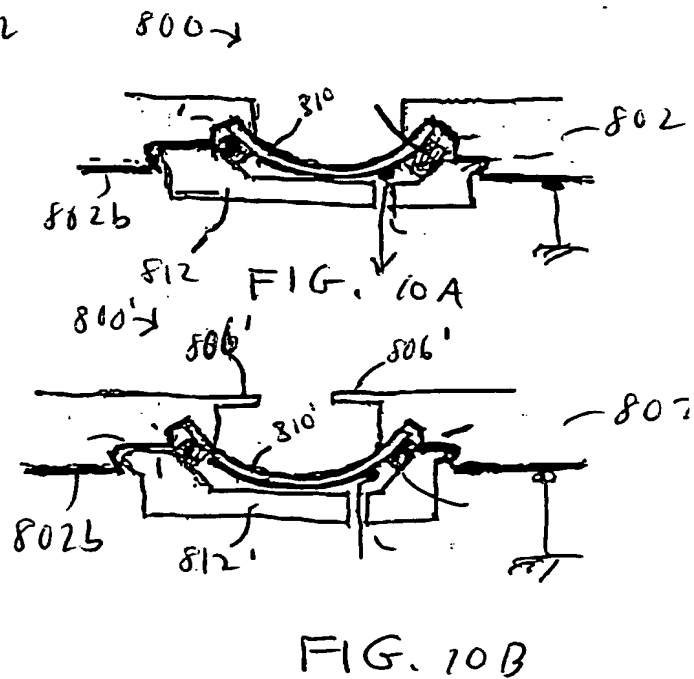
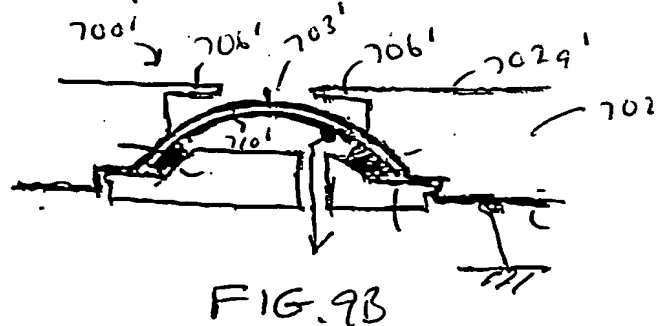
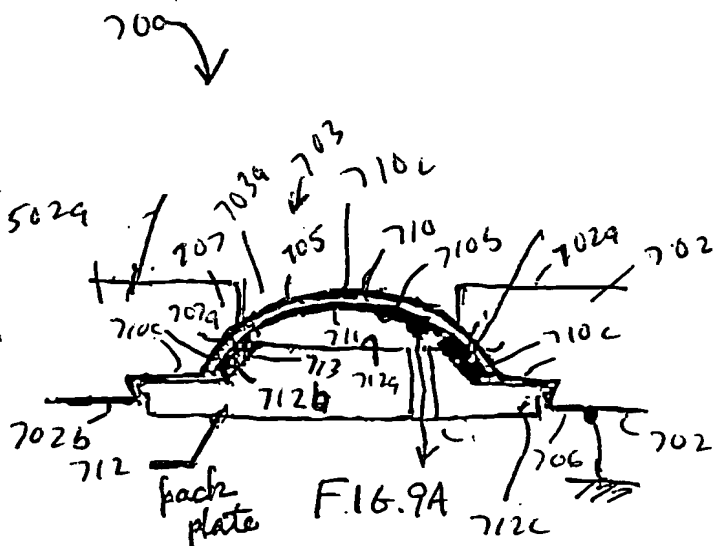
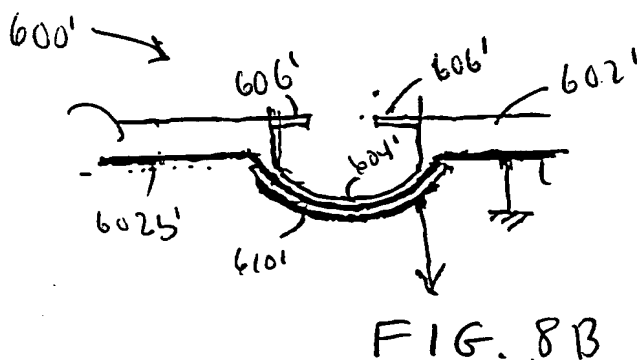
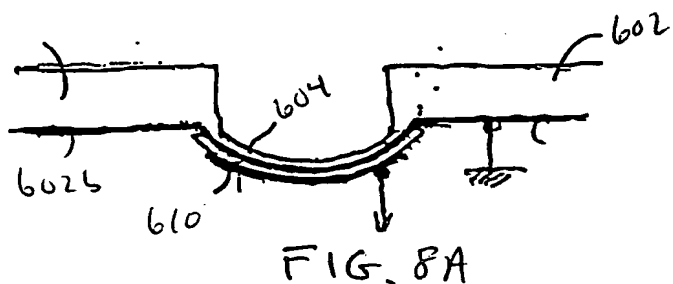
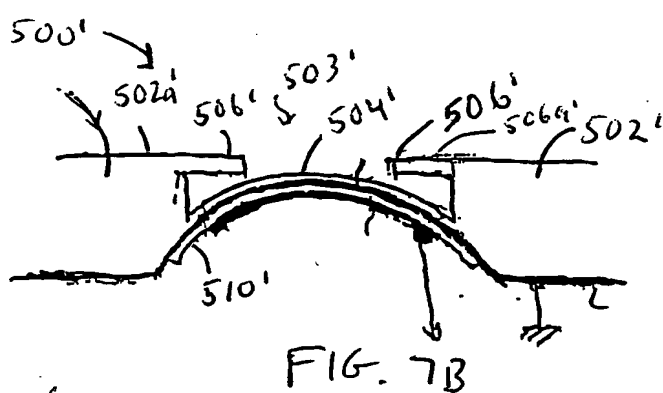
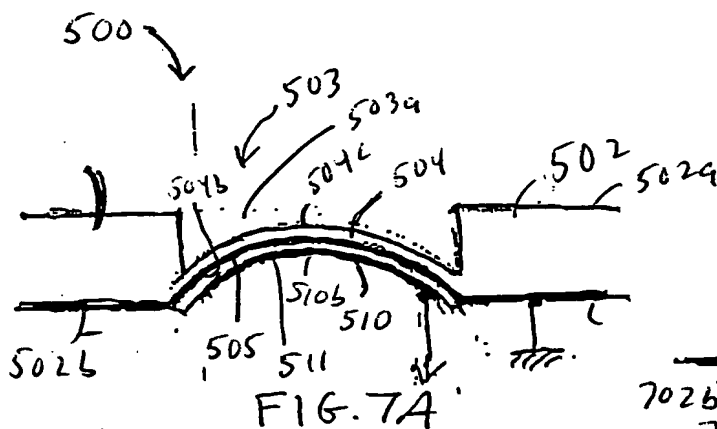


FIG. 6A





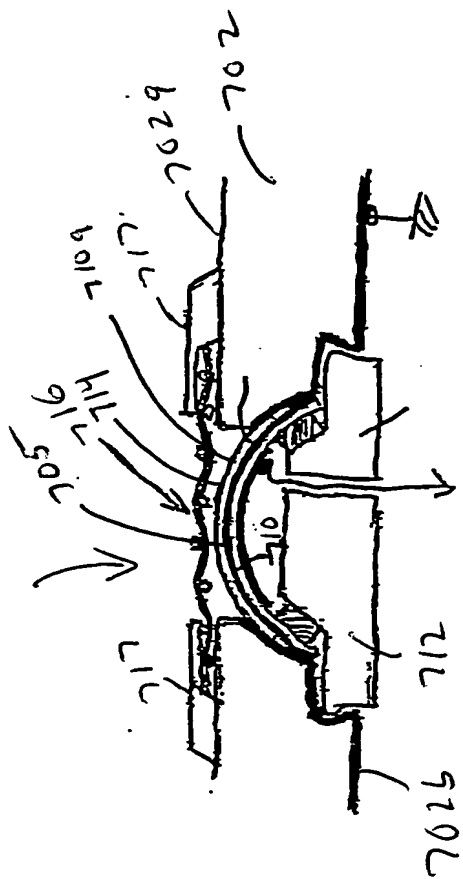


FIG. 11.

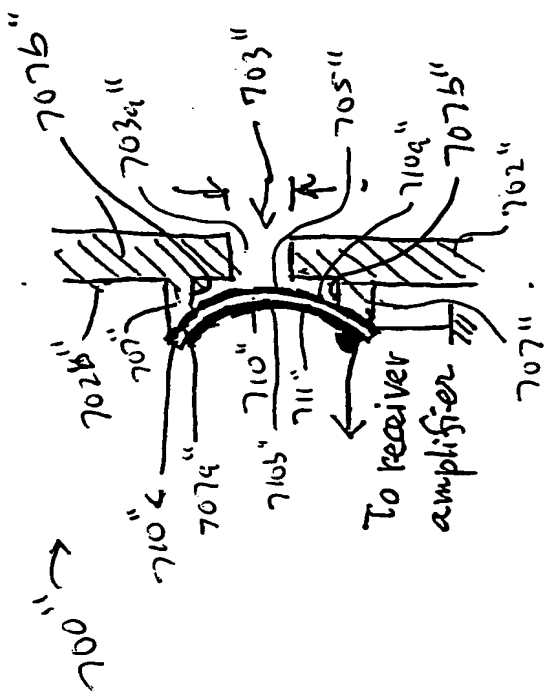
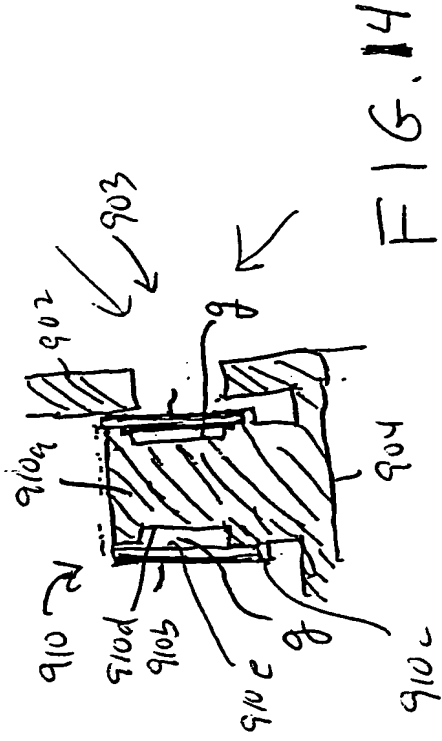
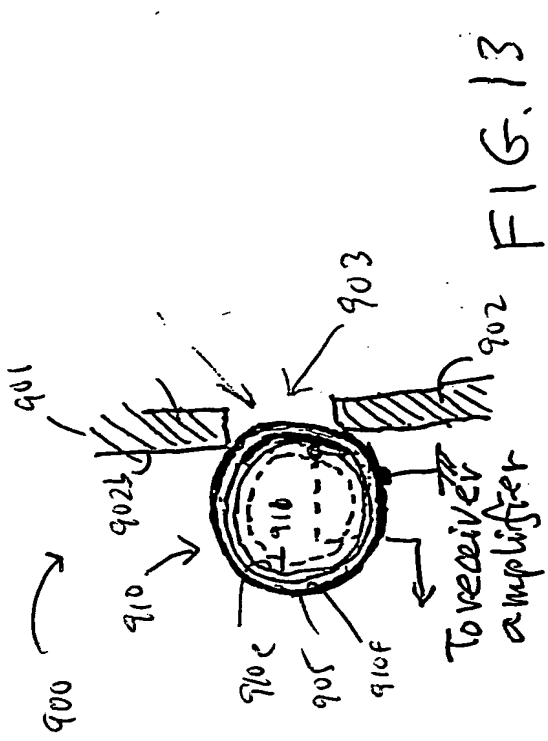


FIG. 12

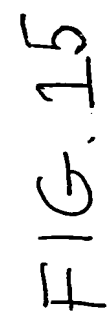


FIG. 15

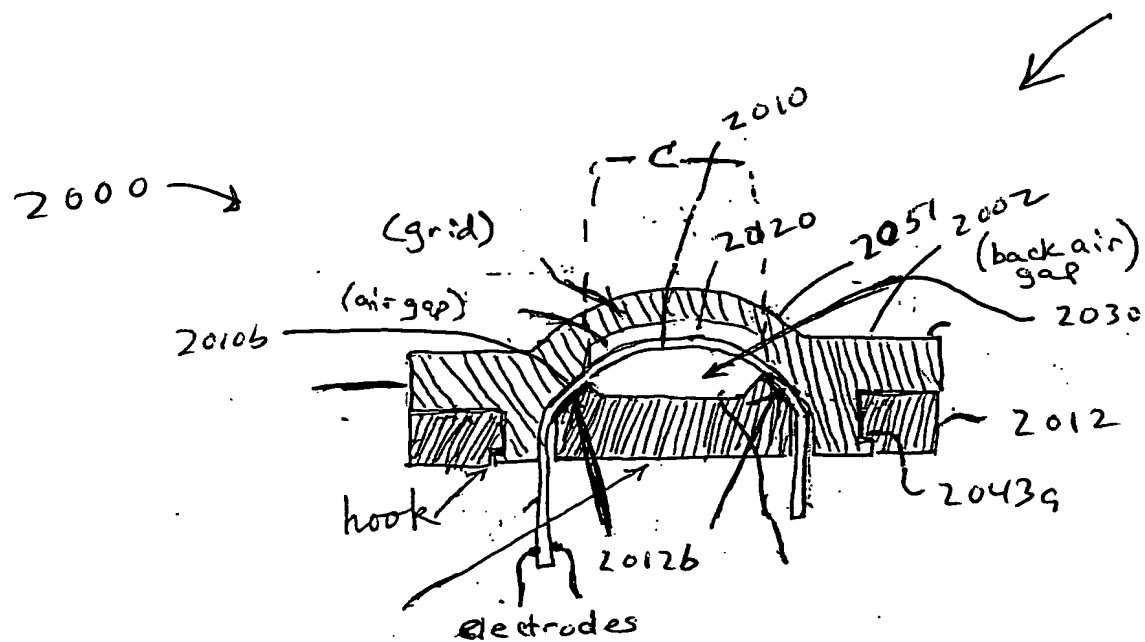


FIG. 16

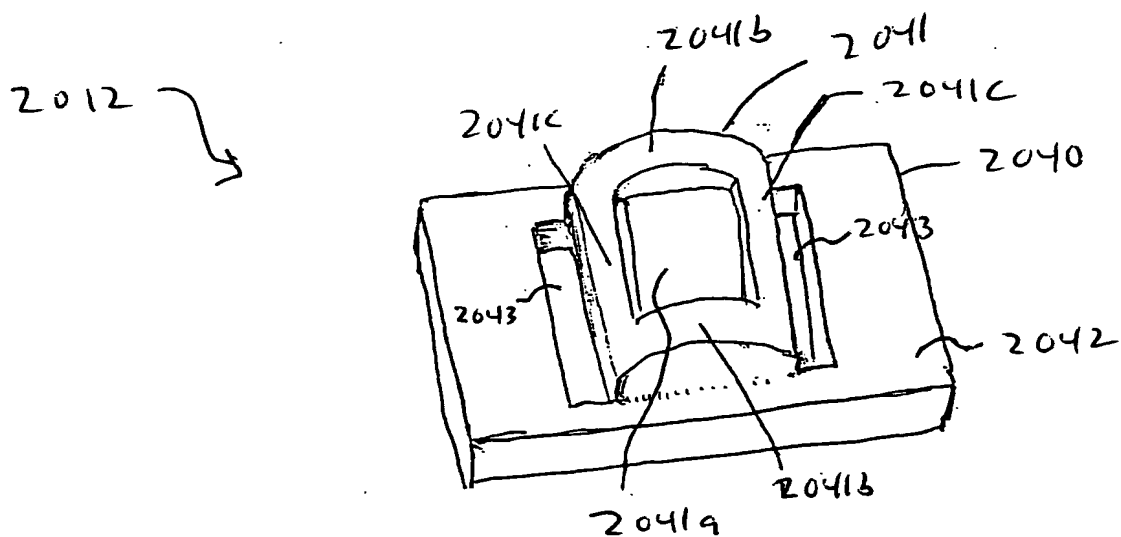
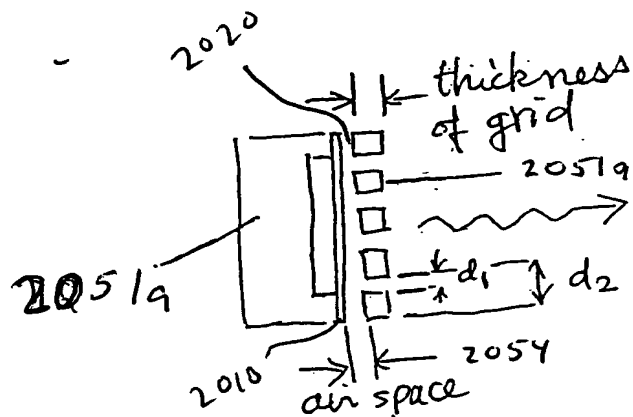
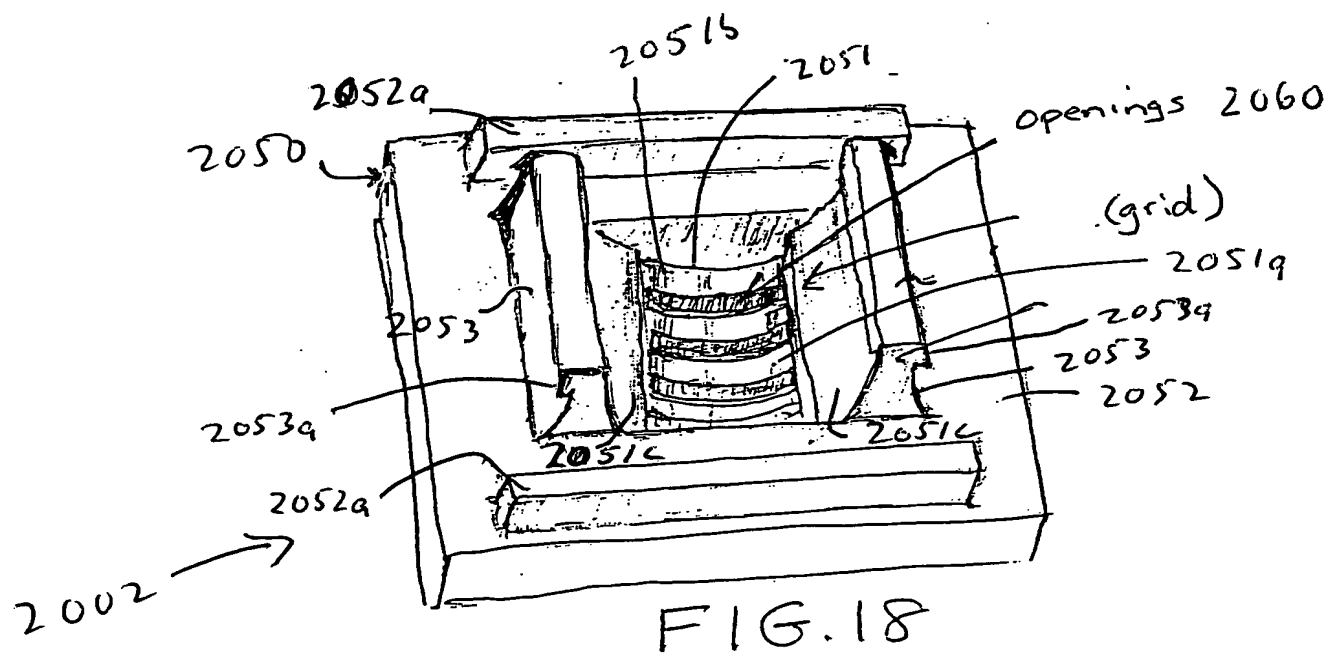


FIG. 17



$$\text{Passage rate} = \frac{d_1}{d_2} \times 100 \%$$

30% passage			45% Passage			60% passage		
Air space	Wall Thick	Improve-ment	Air space	Wall Thick	Improve-ment	Air space	Wall thick	Improve-meent
0.08mm	0.5mm	82%	0.08mm	0.5mm	50%	0.1mm	0.5mm	38%
0.05	1.0	55	0.08	1.0	35	0.1	1.0	22
0.08	1.5	32	0.1	1.5	19	0.1	1.5	8

FIG. 23

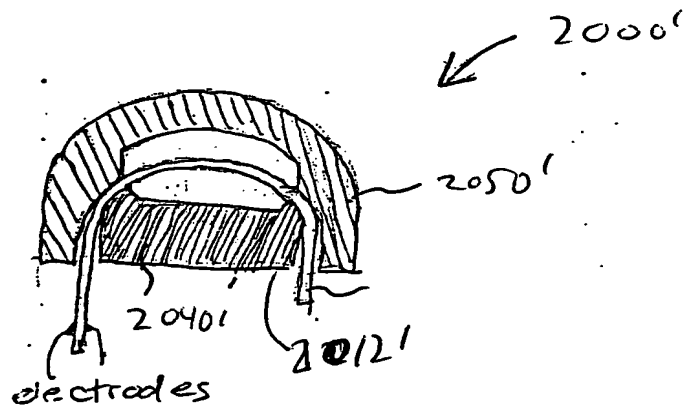


FIG. 20

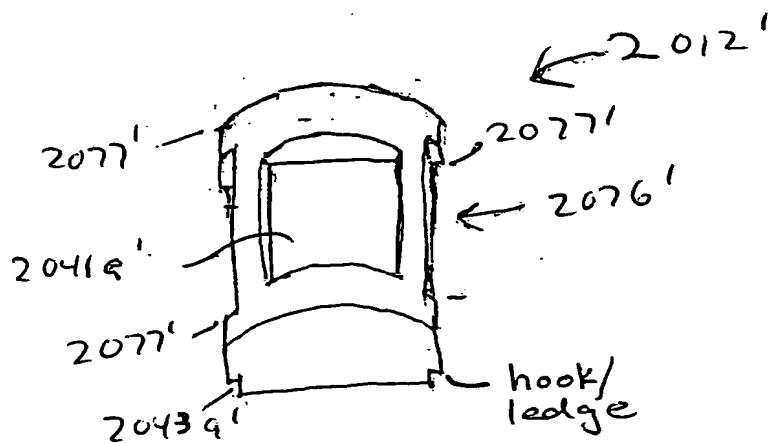


FIG. 21

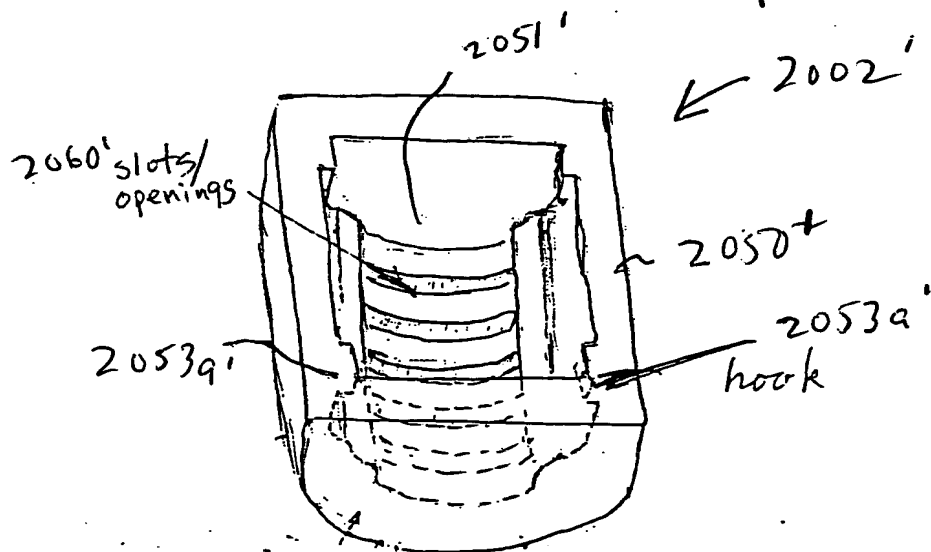


FIG. 22

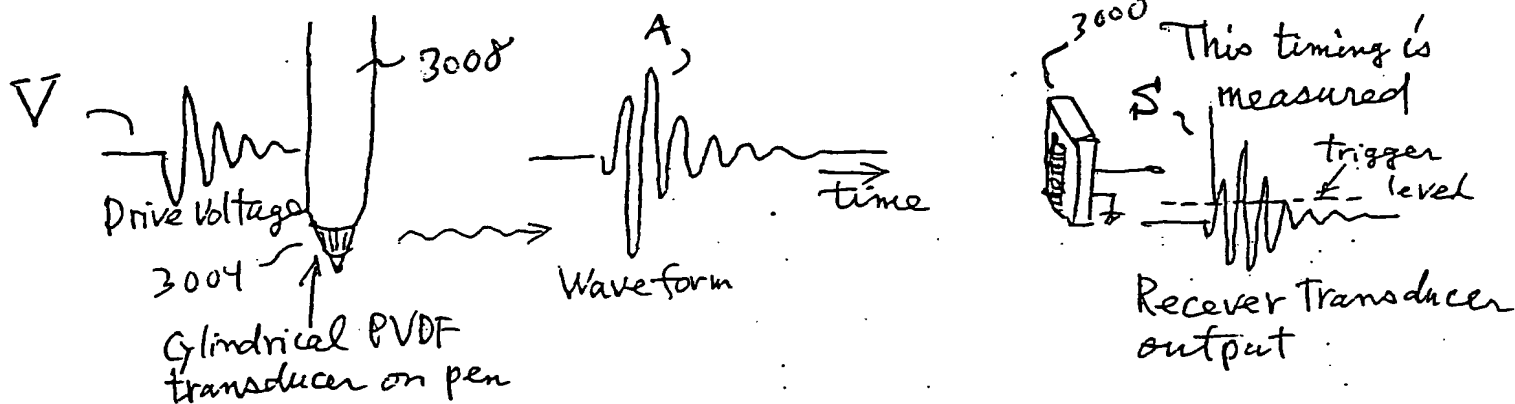


FIG. 24

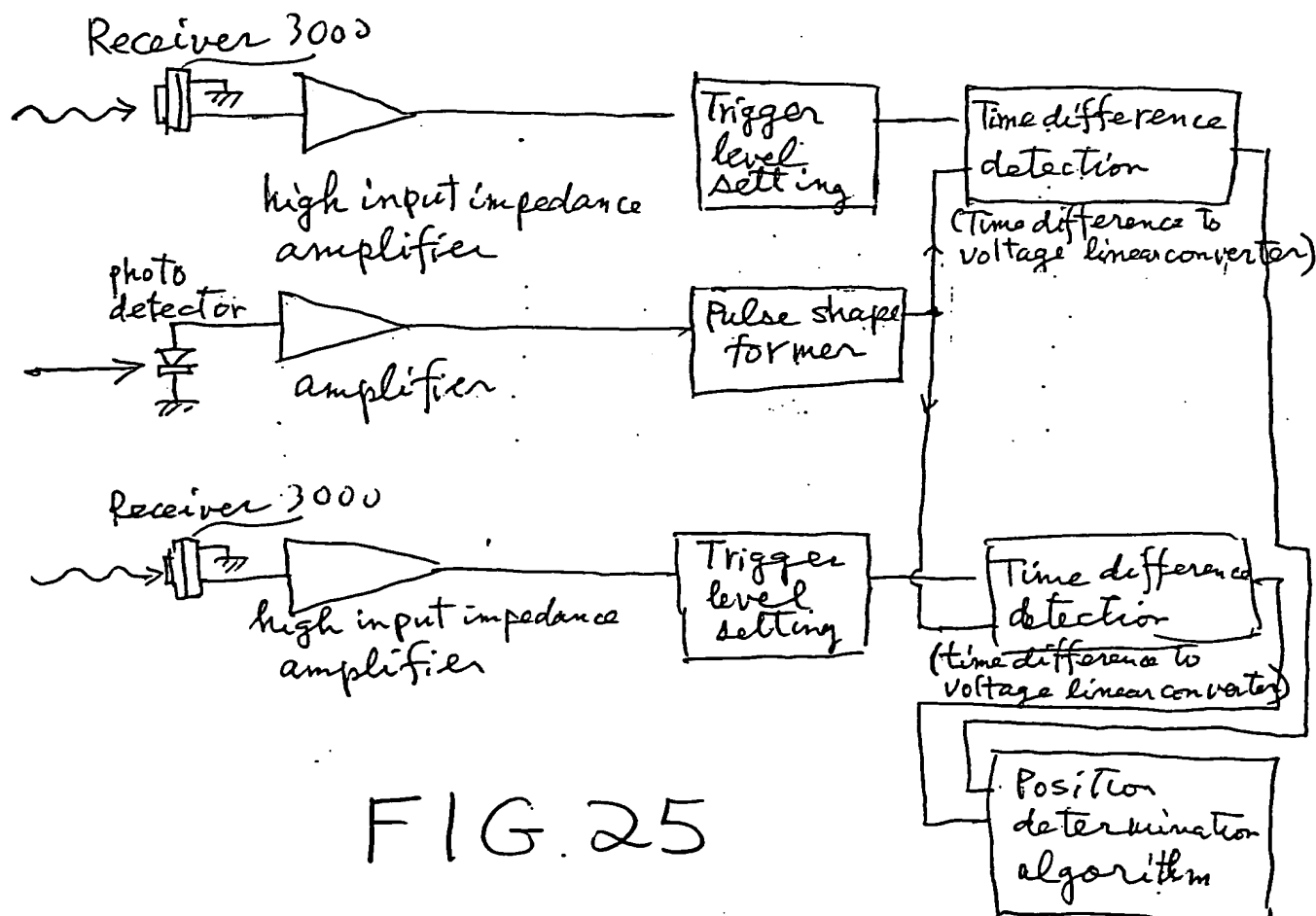


FIG. 25

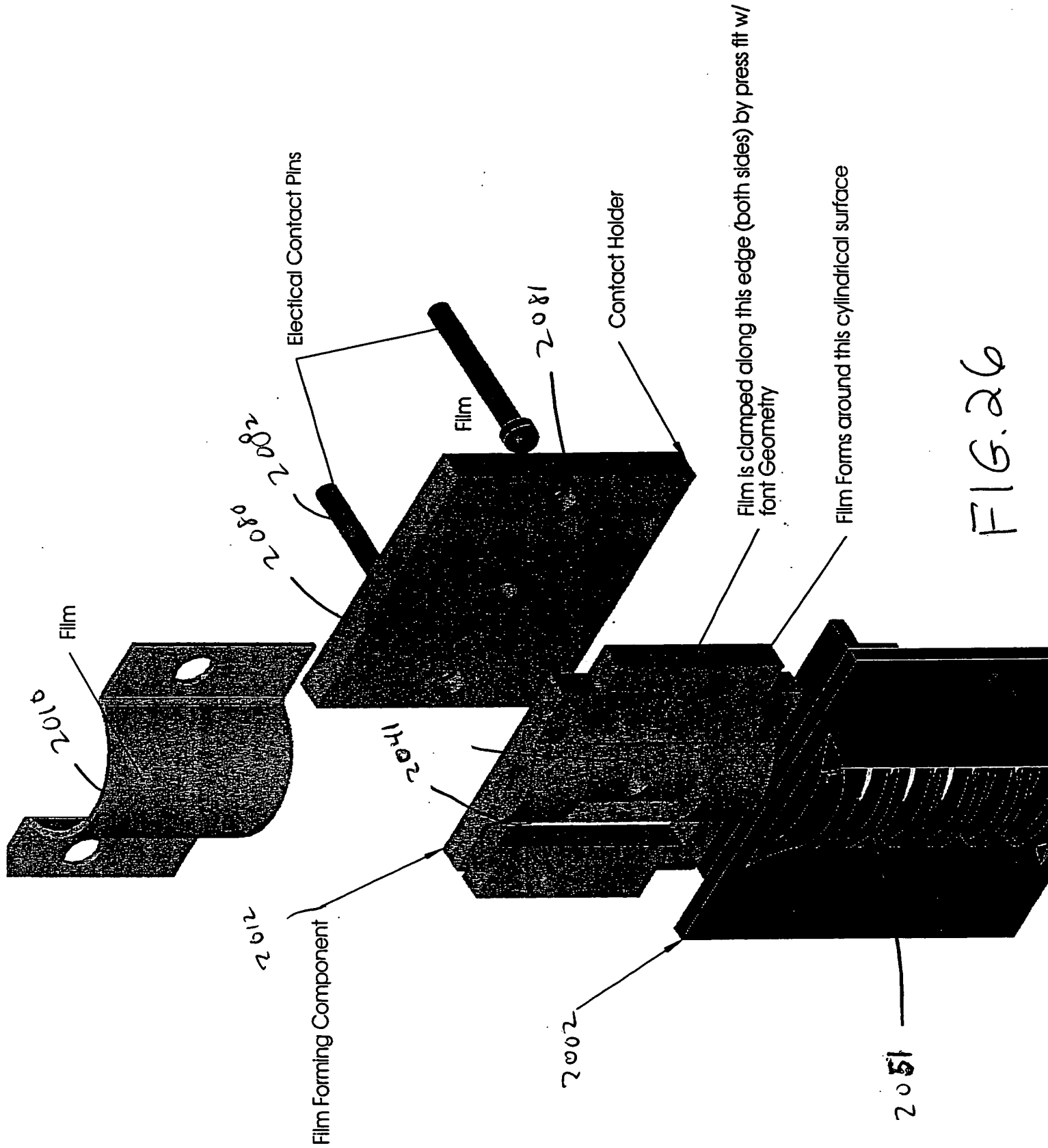


FIG. 26

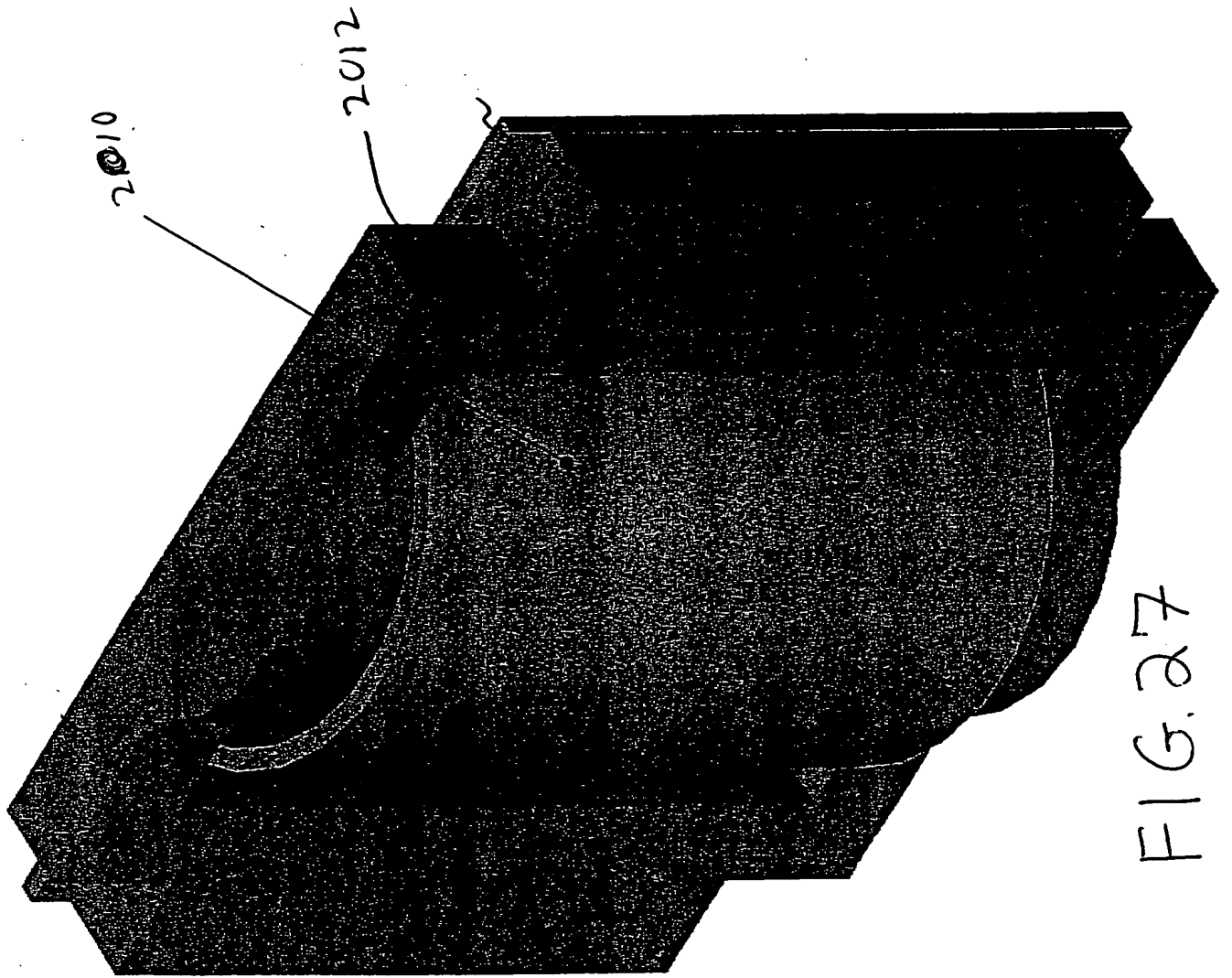


FIG. 27

Plastic contact holder can be ultrasonically welded to the two other plastic pieces of the assembly joining the entire assembly together

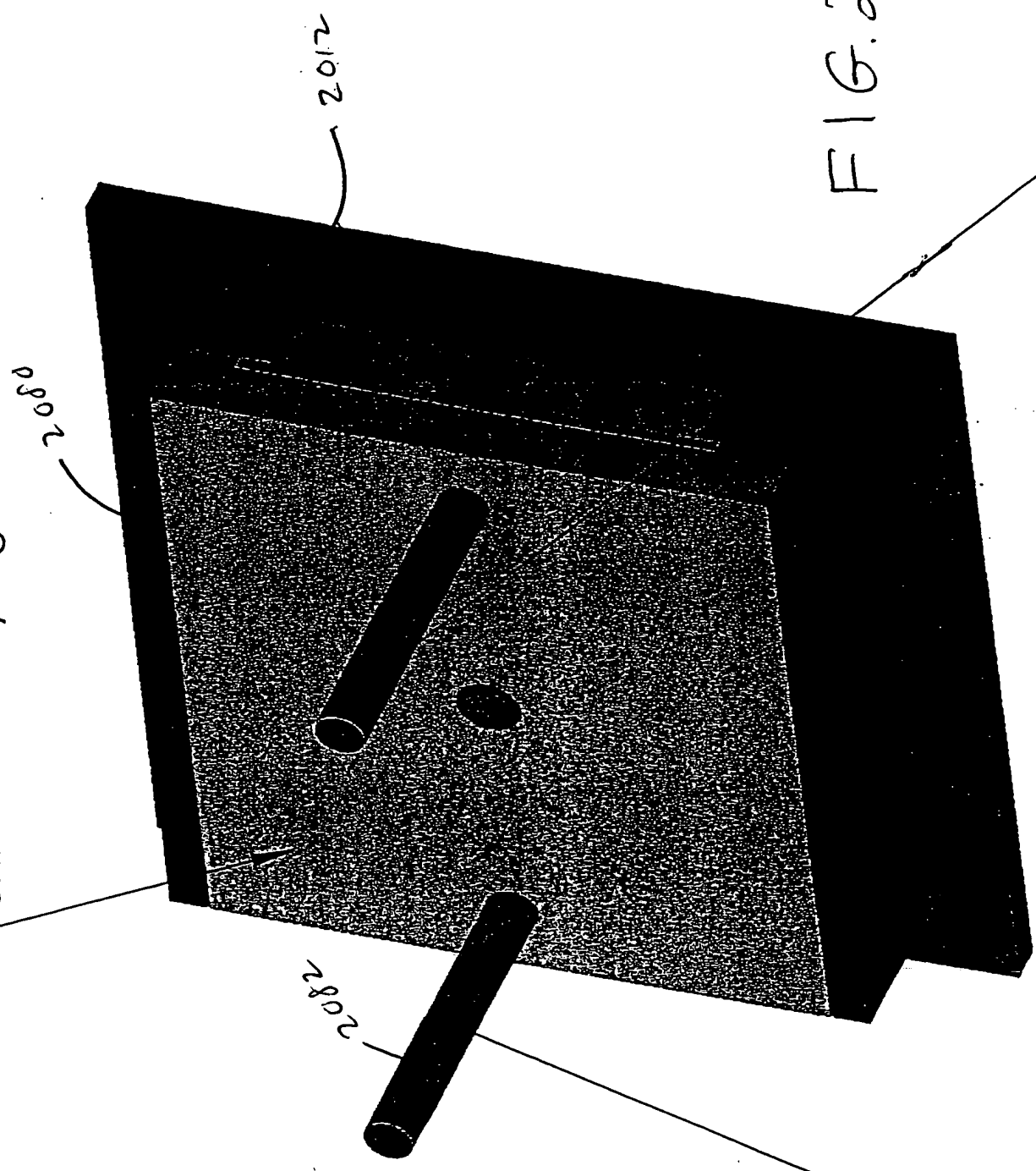
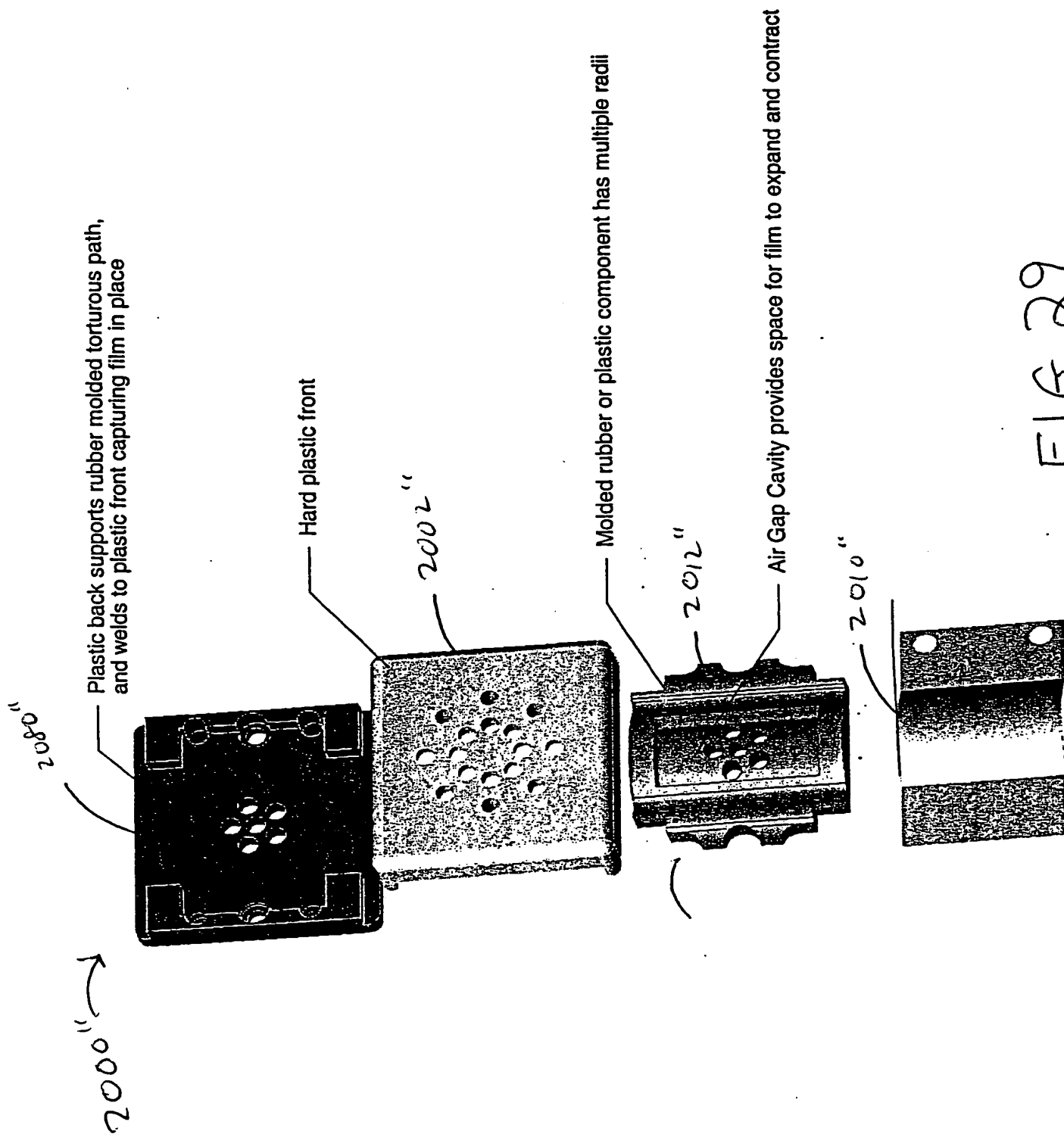


FIG. 28

Electrical contacts can be press fit or insertmolded into The Plastic Contact holder and individually make contact to the positive and negative side of the Piezo Film



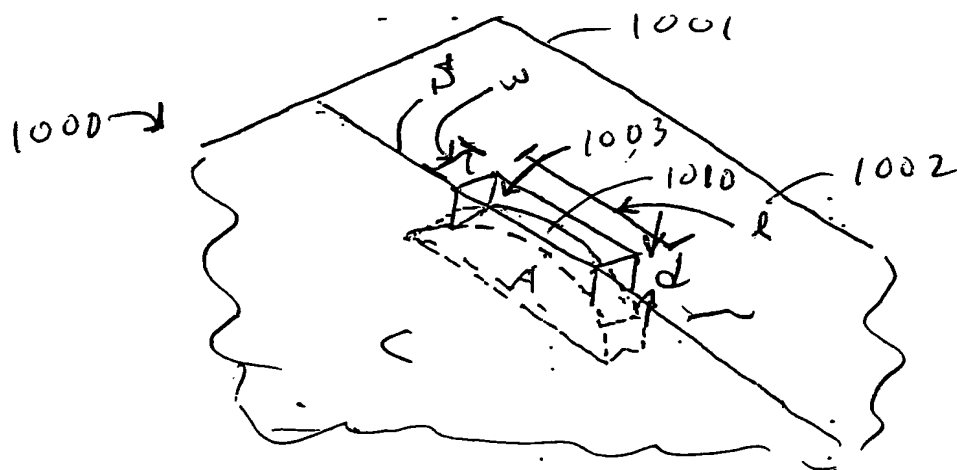


FIG. 30A

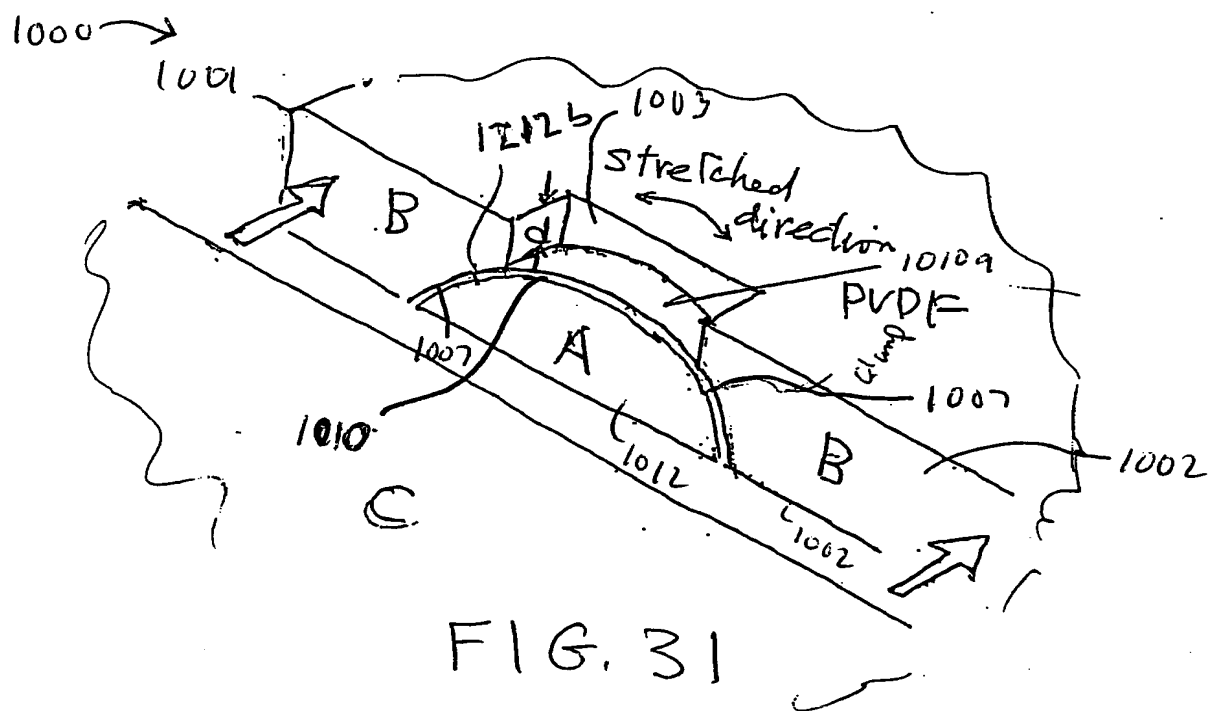


FIG. 31

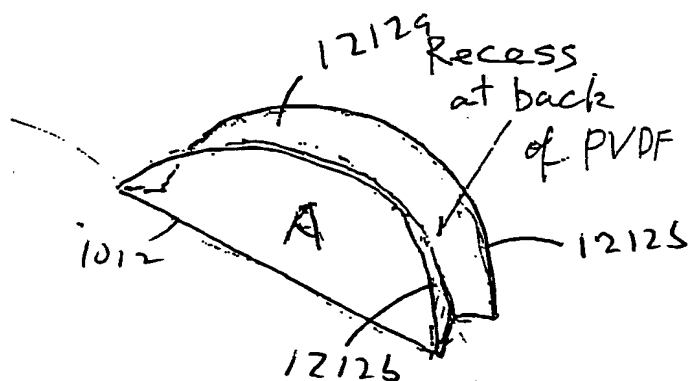


FIG. 32

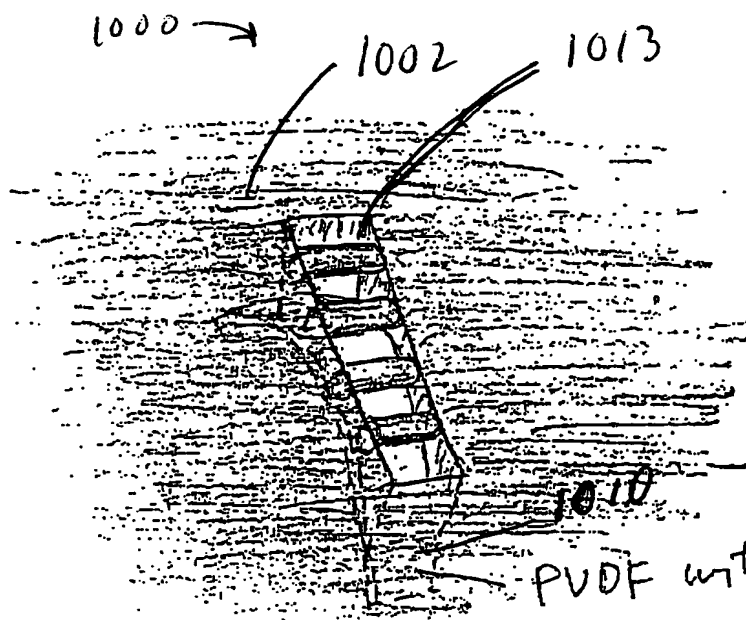


FIG. 30B

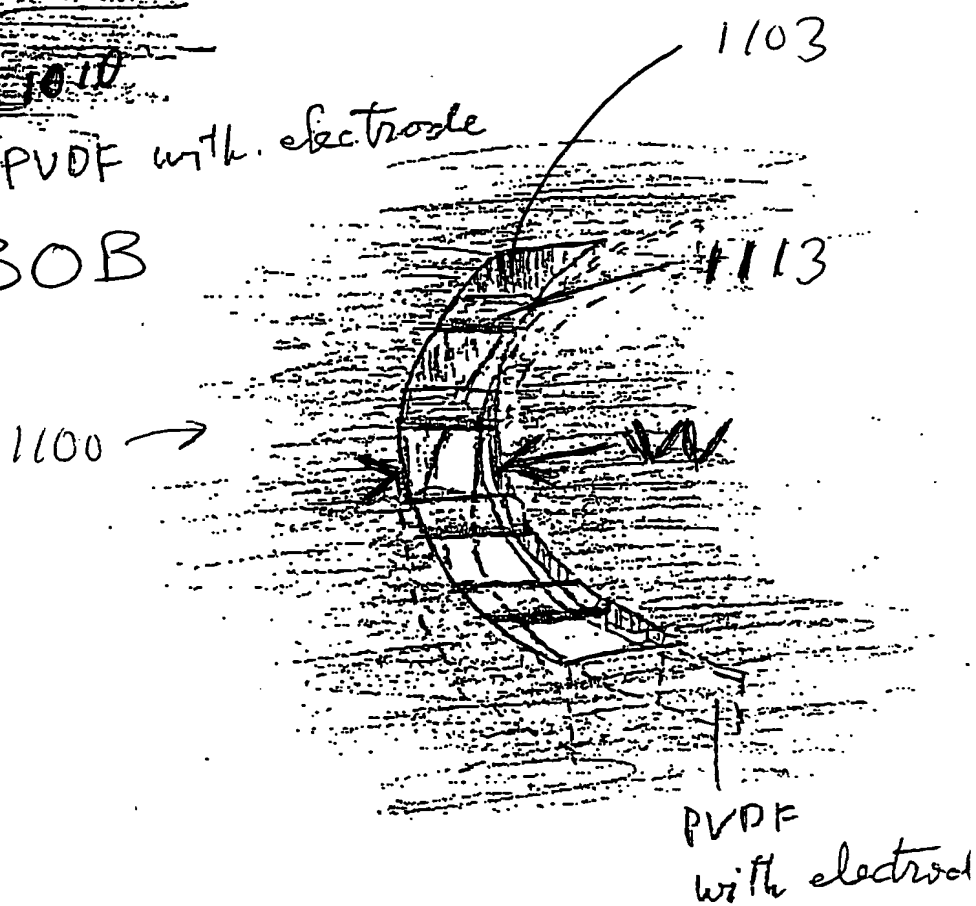


FIG. 33B

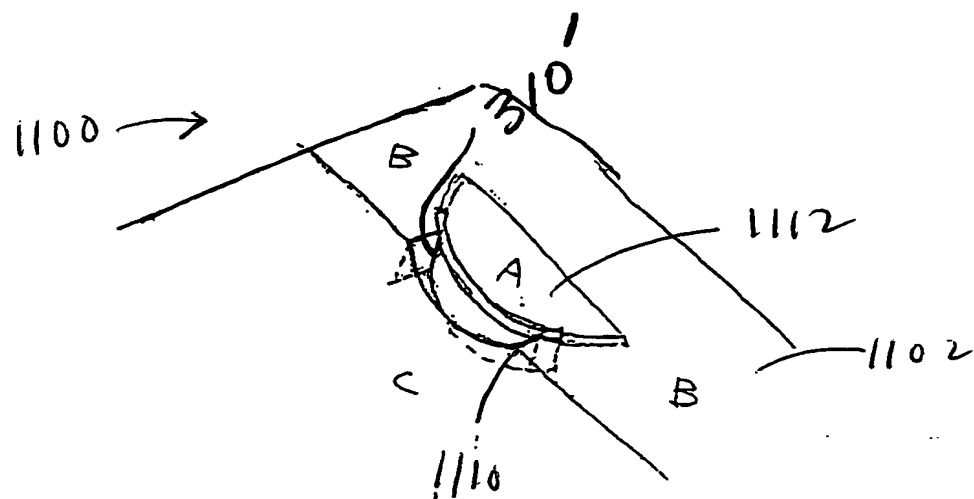


FIG. 33A

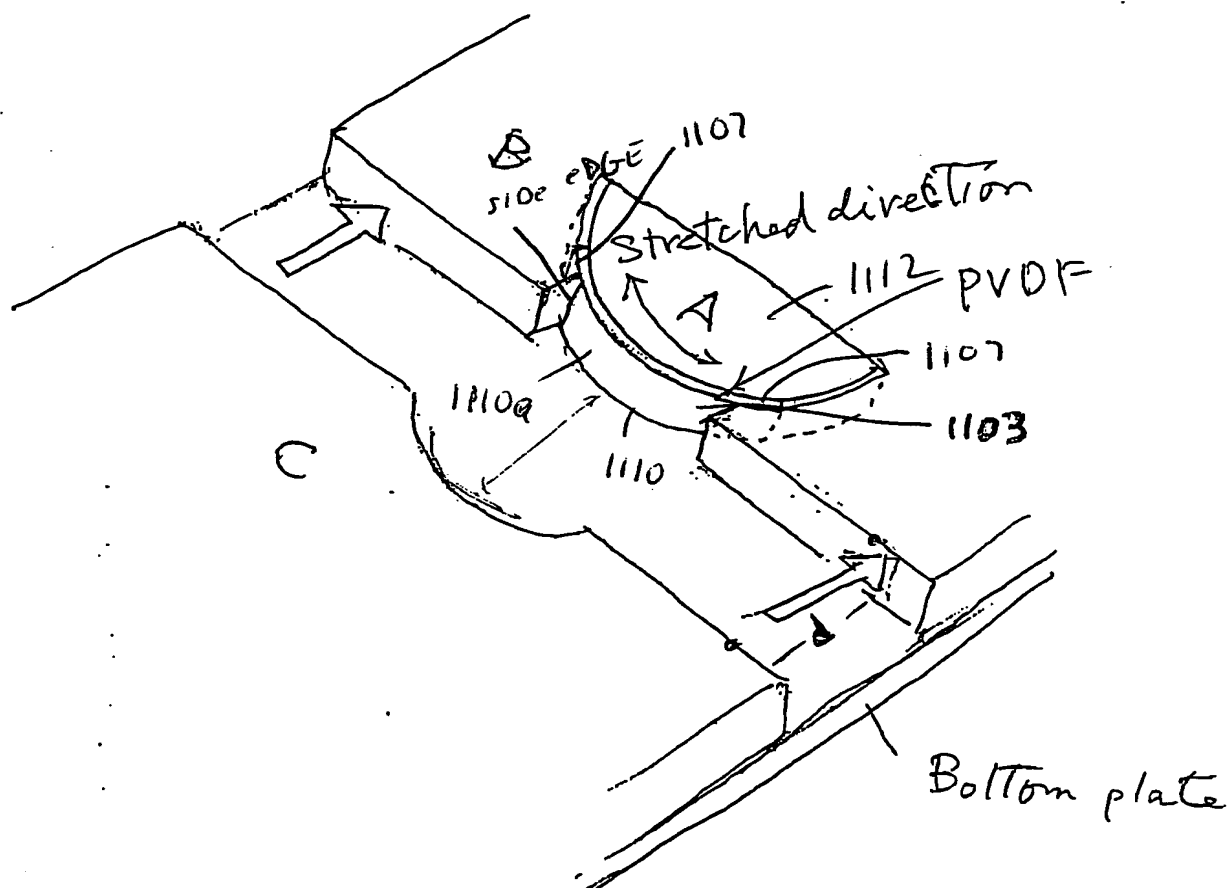


FIG. 34

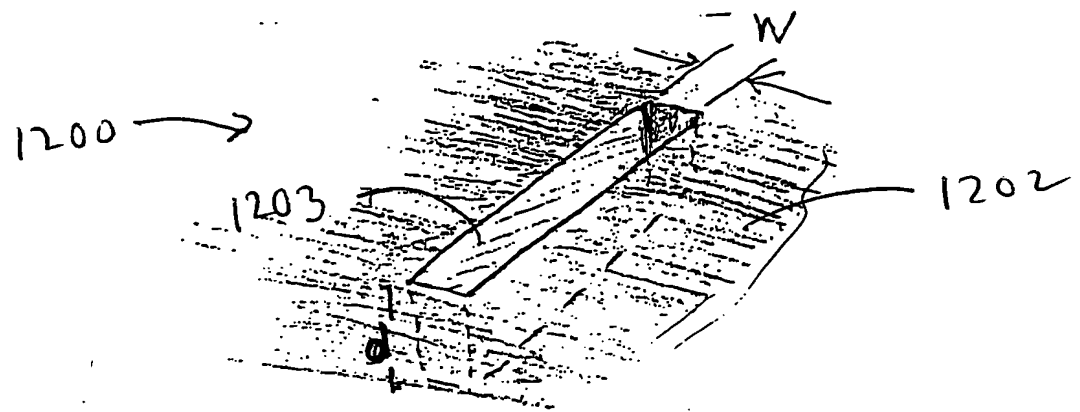


FIG. 35A

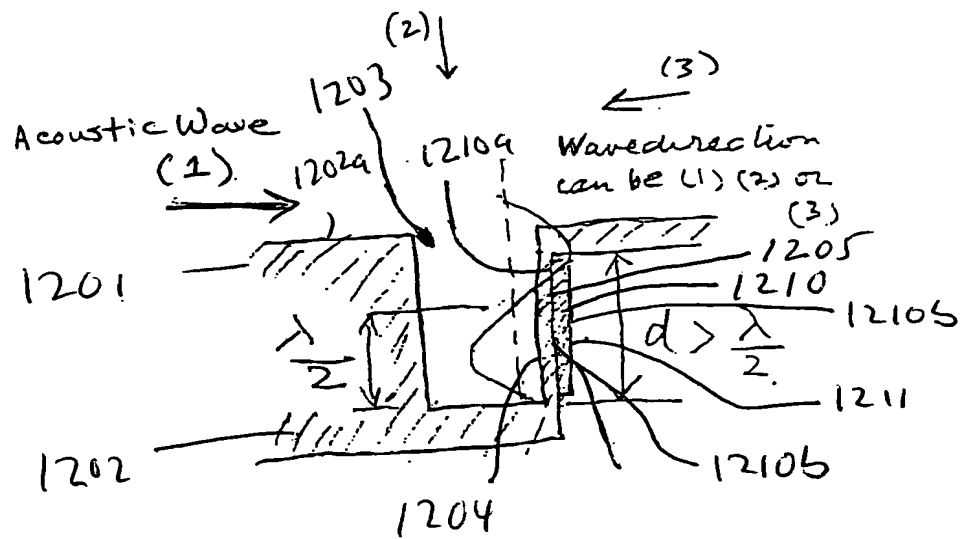


FIG. 35E

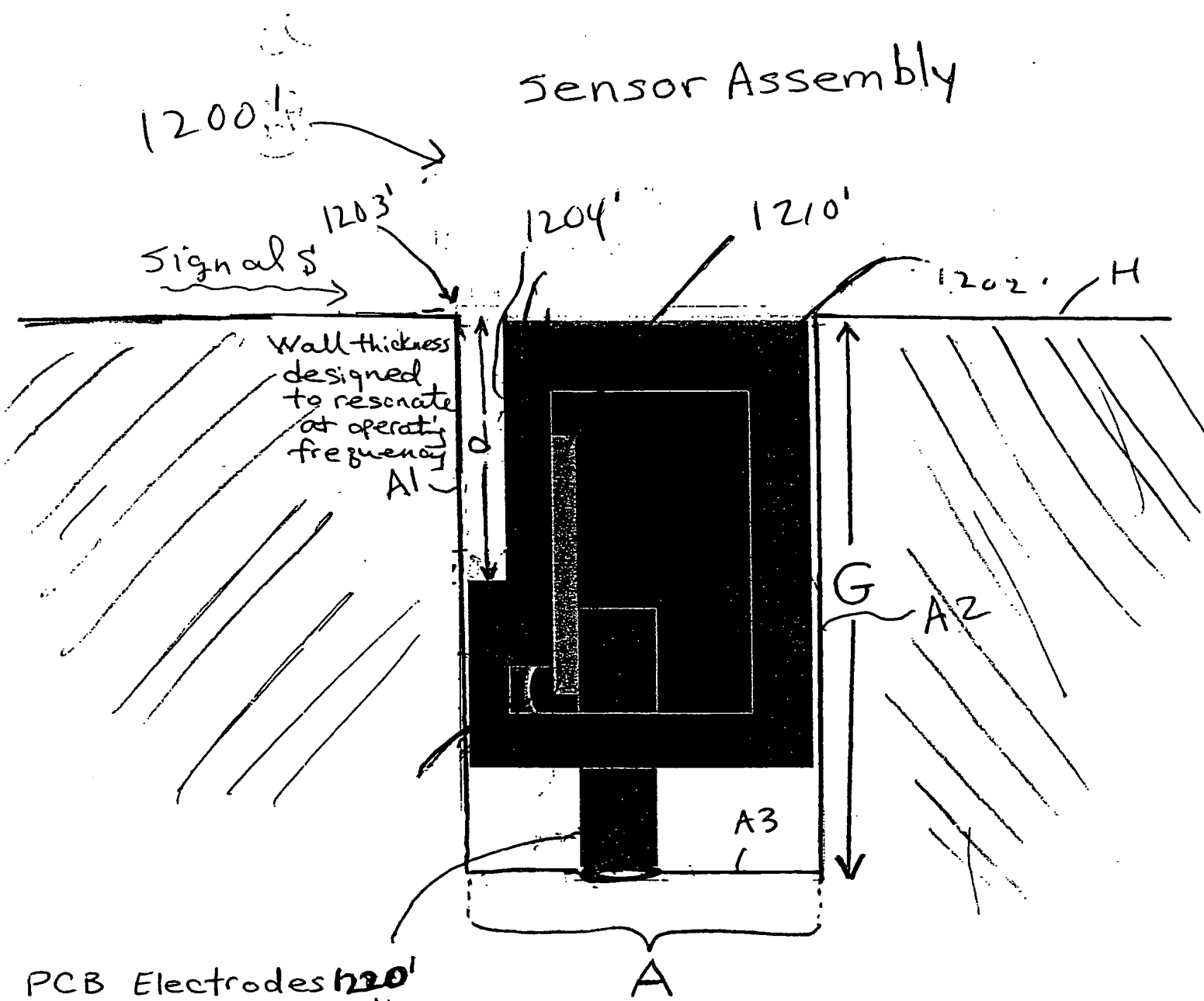


FIG. 35C

Sensor Assembly

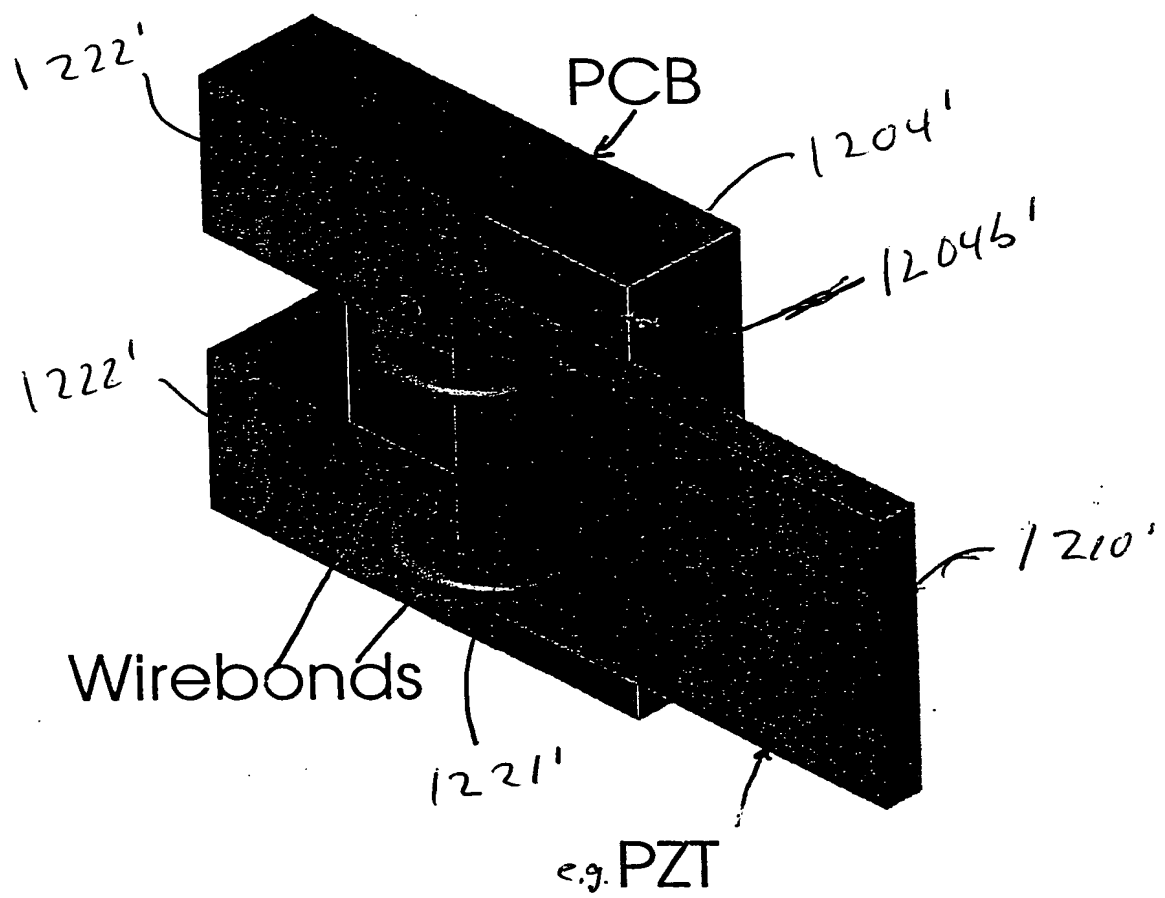
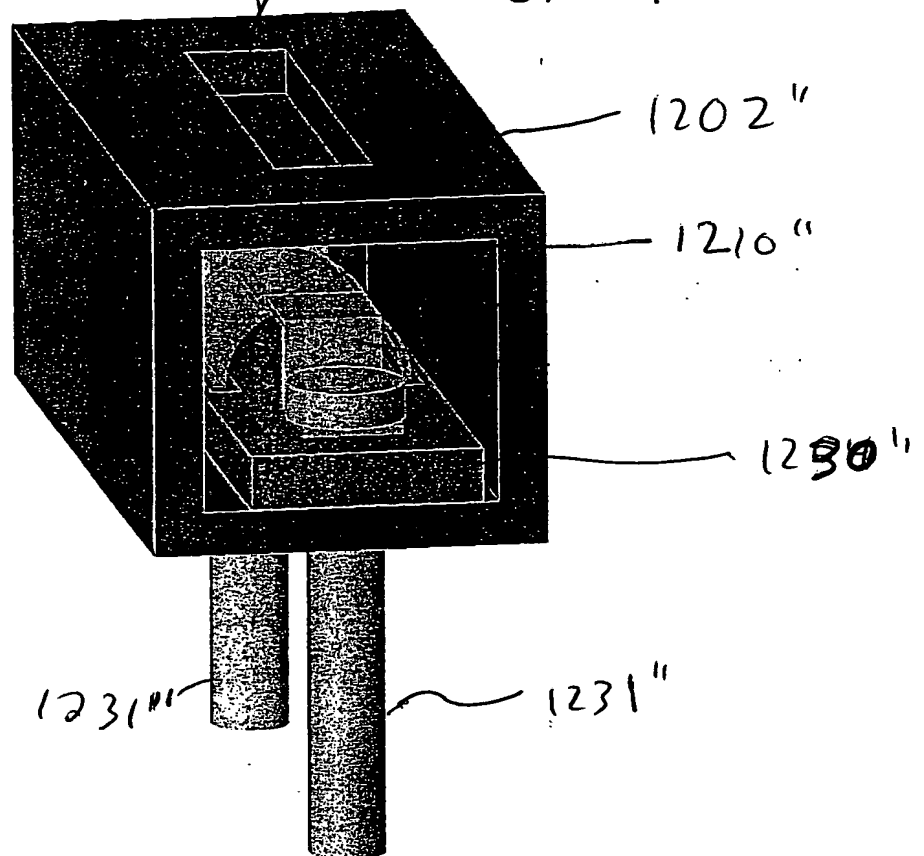


FIG. 35D

1200" →

Semi-Cylindrical Sensor

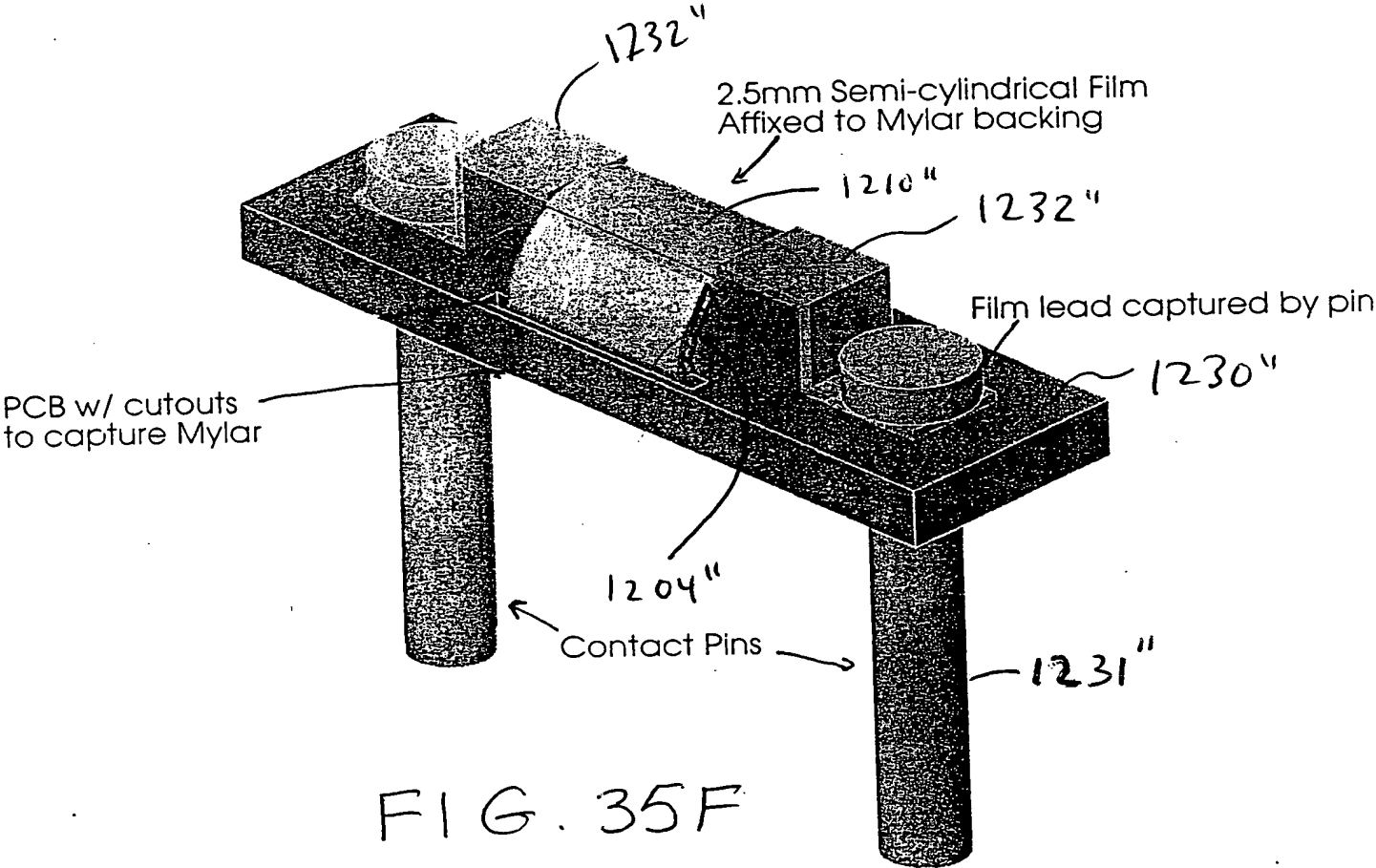
Plastic Housing w/
Cutout for Accoustic Energy to pass



Electric Contacts pass through
housing to connect to main circuit

FIG. 35 E

Semi Cylindrical Sensor



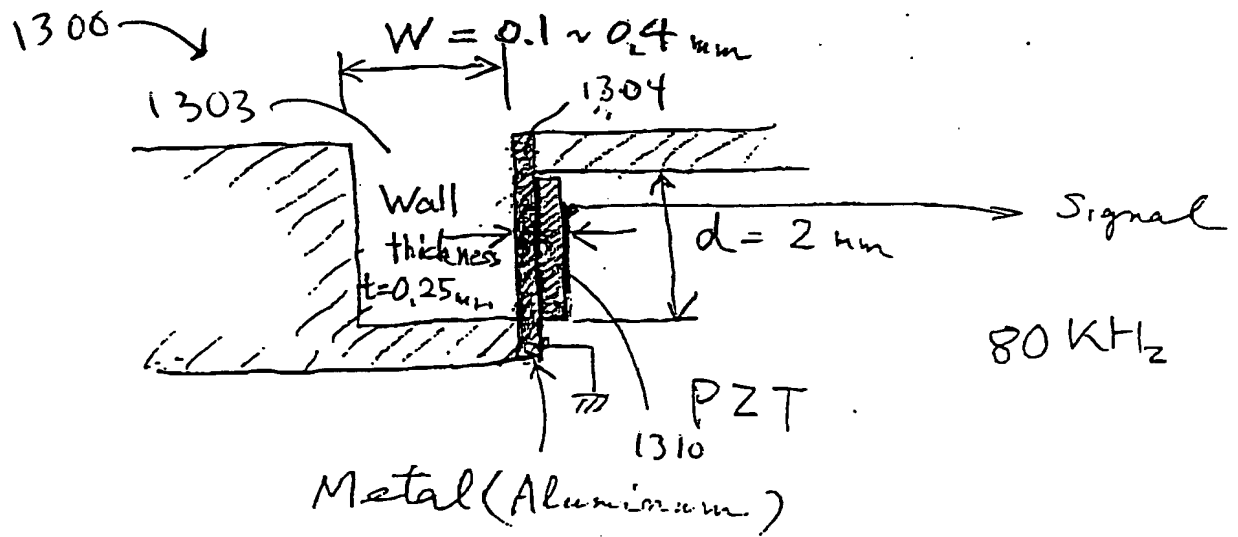


FIG. 36

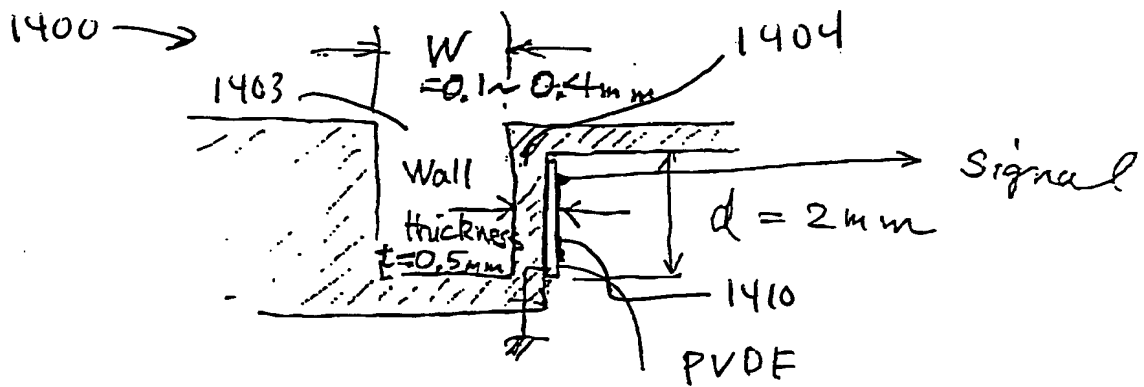


FIG. 37

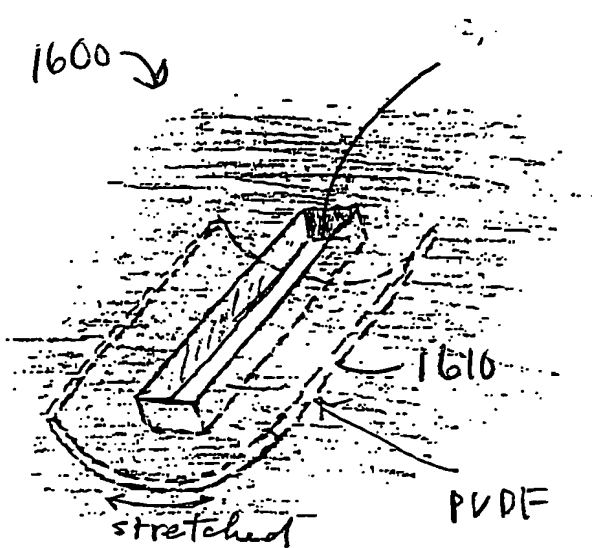


FIG. 38A

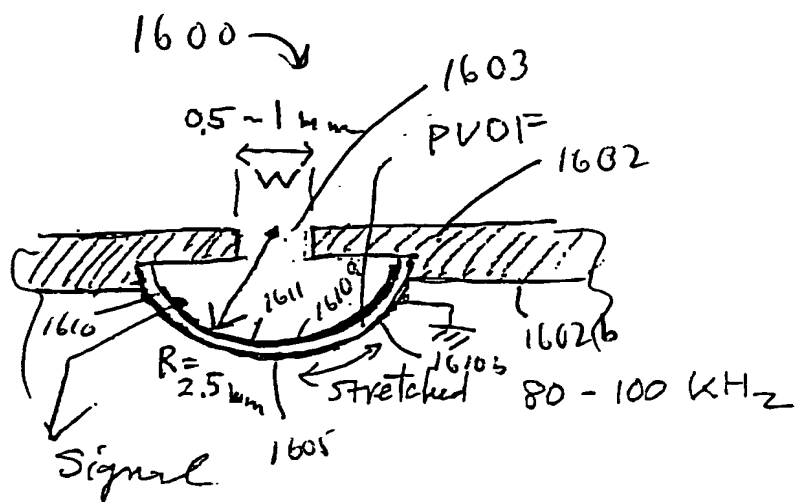


FIG. 38B

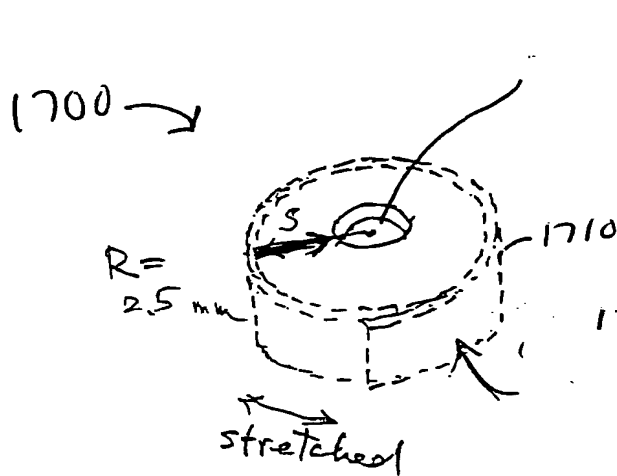


FIG. 39A

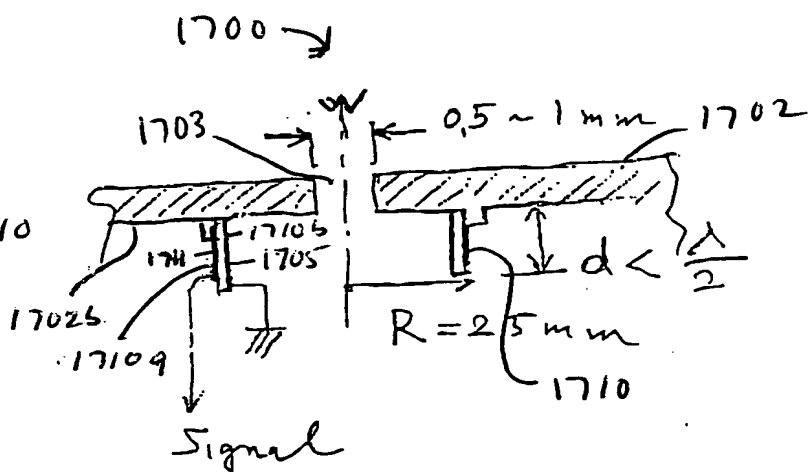


FIG. 39B

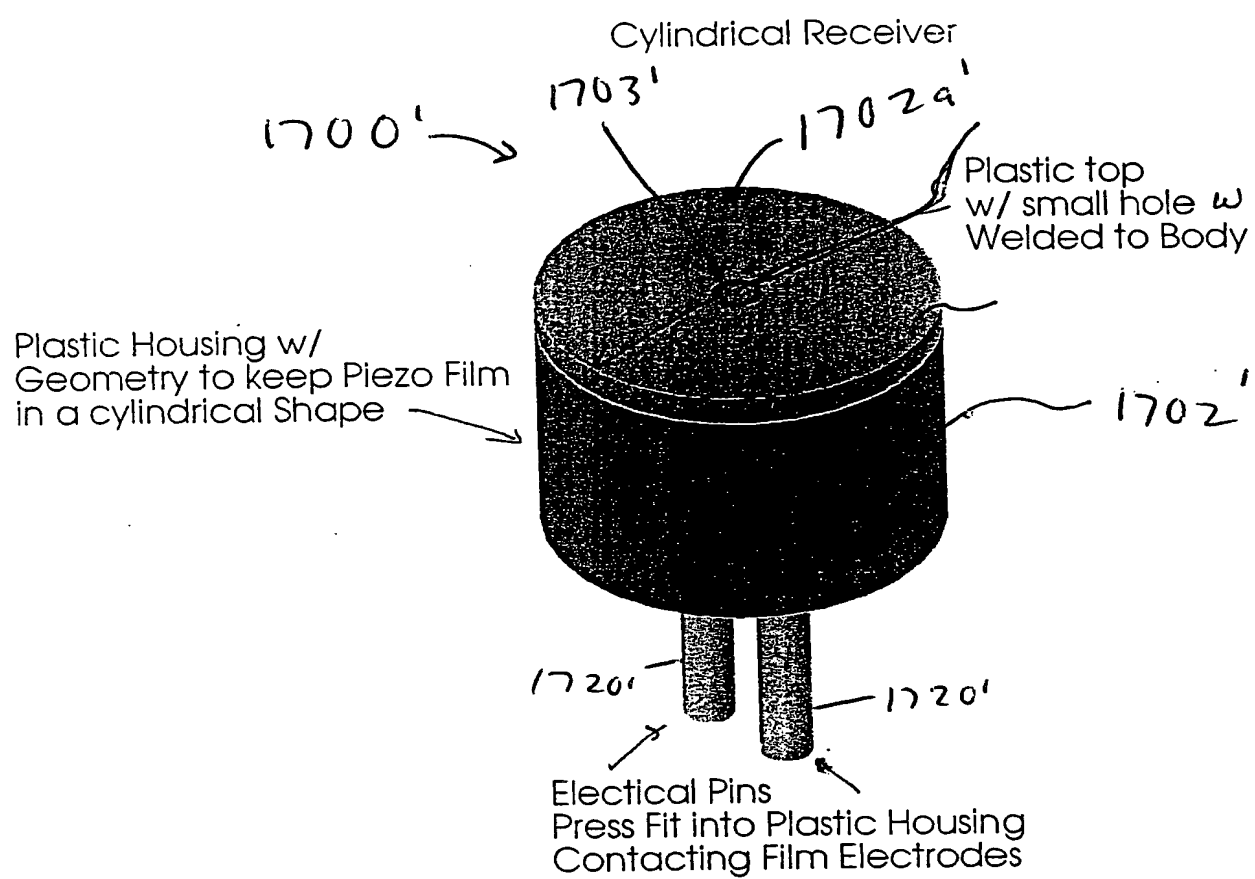


FIG. 39C

Plastic Housing w/
Geometry to keep Piezo Film
in a cylindrical Shape

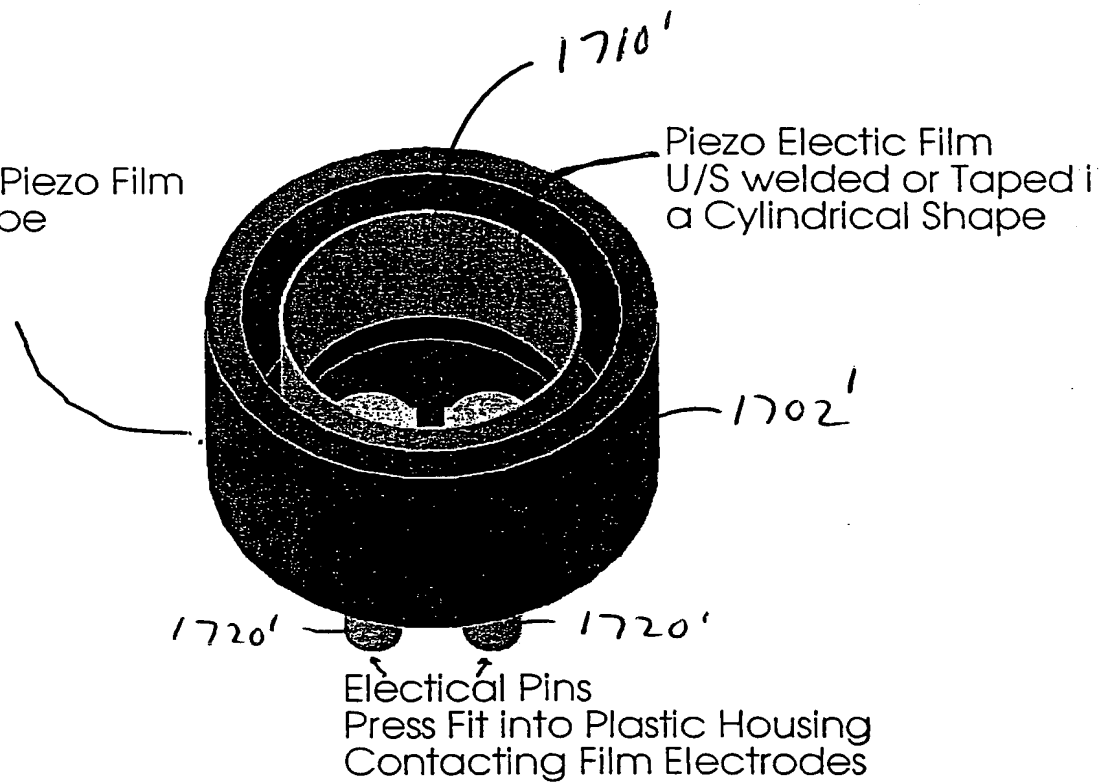


FIG. 39D

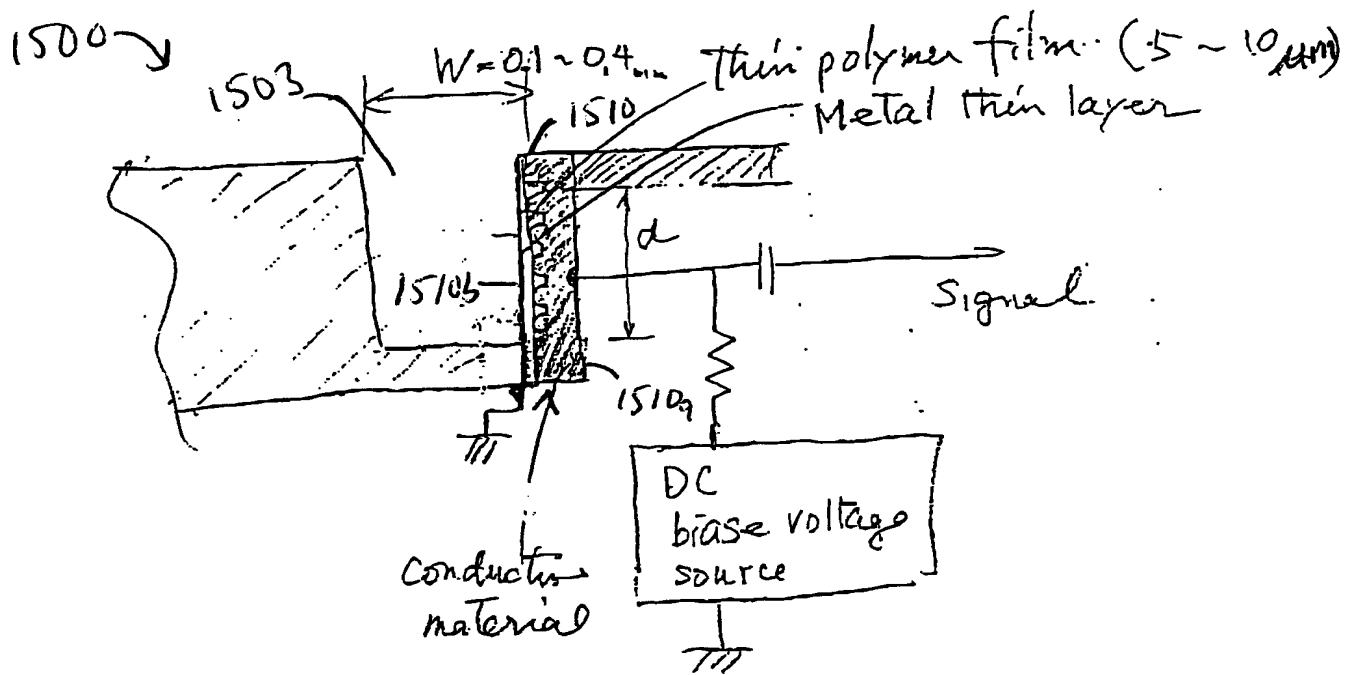


FIG. 40

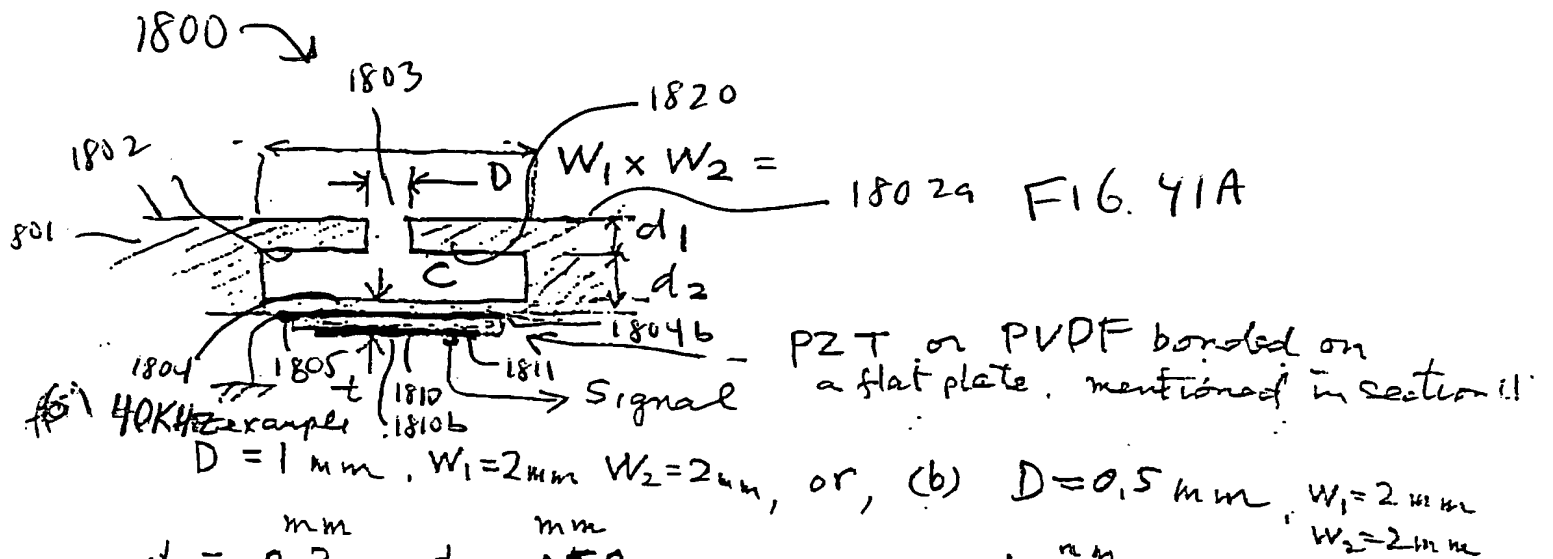


FIG. 41A

$D = 1 \text{ mm}$, $W_1 = 2 \text{ mm}$, $W_2 = 2 \text{ mm}$, or, (b) $D = 0.5 \text{ mm}$, $W_1 = 2 \text{ mm}$, $W_2 = 2 \text{ mm}$

d_1 mm	d_2 mm
0.3	0.52
0.5	0.35
0.75	0.27
1.0	0.19
1.5	0.05

d_1 mm	d_2 mm
0.3	0.18
0.5	0.12
0.75	0.09
1.0	0.05
1.5	0.02

FIG. 41B

Capacitive Micro Machined Ultrasonic Transducer (c-MUT)

Following numbers are example of c-MUT diaphragm; material is silicon nitride.

(a) 1-2 MHz range design ($\lambda = 0.34 - 0.17$ mm)

Diaphragm diameter ; 50 μ m , thickness 0.5 - 1 μ m

(b) 300 - 900KHz ; ($\lambda = 1.1 - 3.8$ mm)

Diaphragm diameter ; 200 μ m , thickness 2.5 - 7.5 μ m

(c) 80 -200 KHz design ; ($\lambda = 4.3 - 1.7$ mm)

Diaphragm diameter 0.4 mm, thickness 3 - 7 μ m

In all the design, the diameters are roughly equal to quarter wavelength or smaller. In such a condition, the sensitivity has no angle dependence (no directivity).

Such a transducer can be mounted on the surface of receiving equipment.

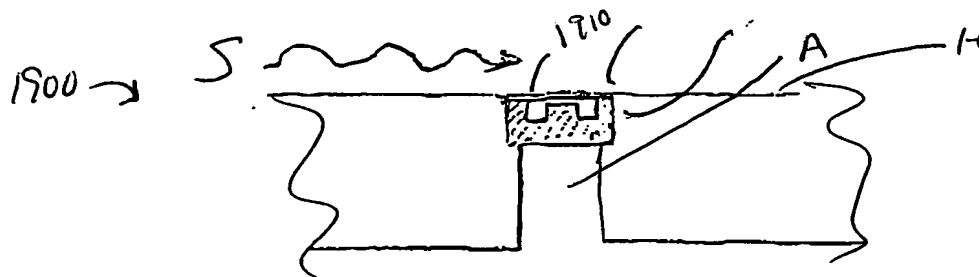


FIG. 42

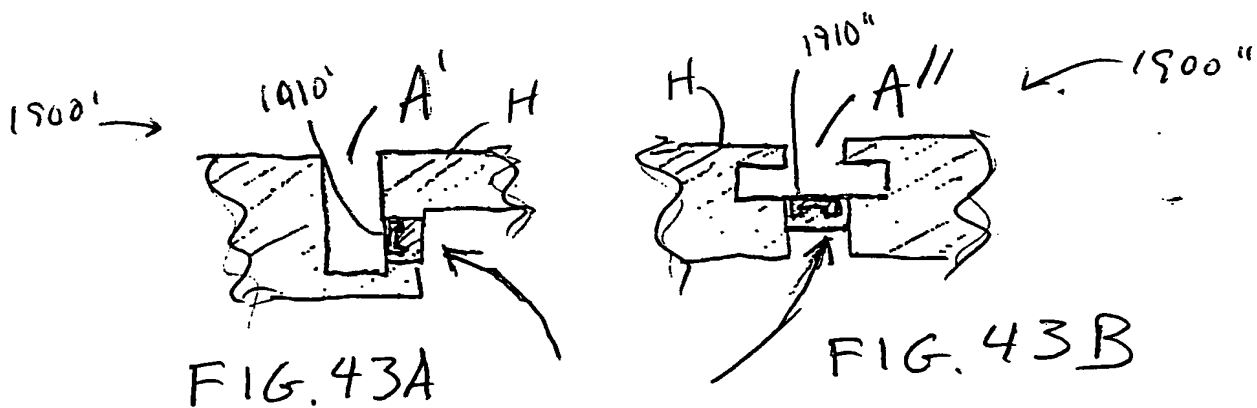


FIG. 43A

FIG. 43B

Desktop computer,

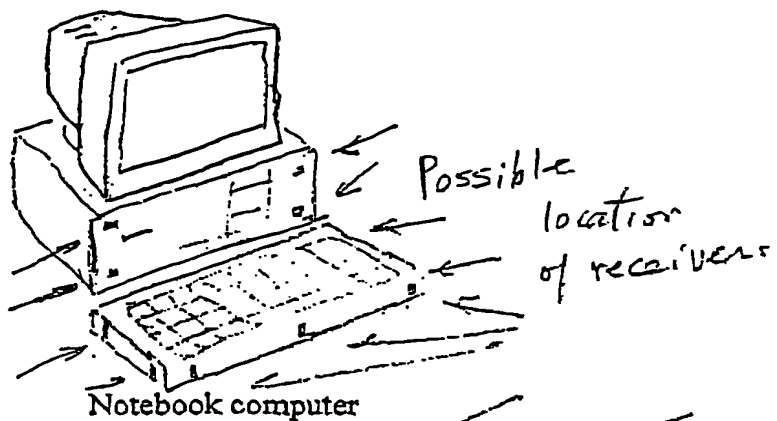


FIG. 44A

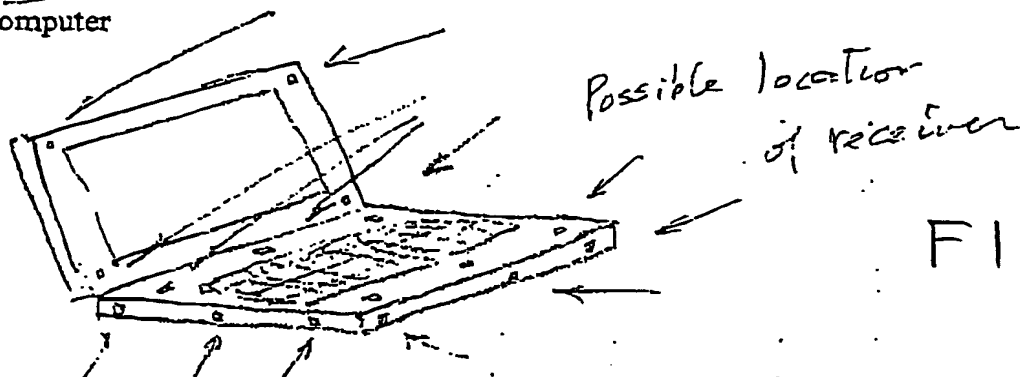


FIG. 44B

PDA

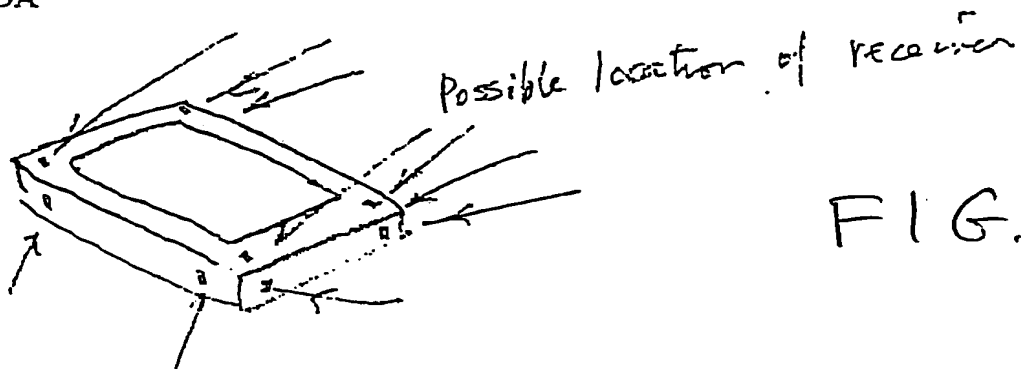


FIG. 44C

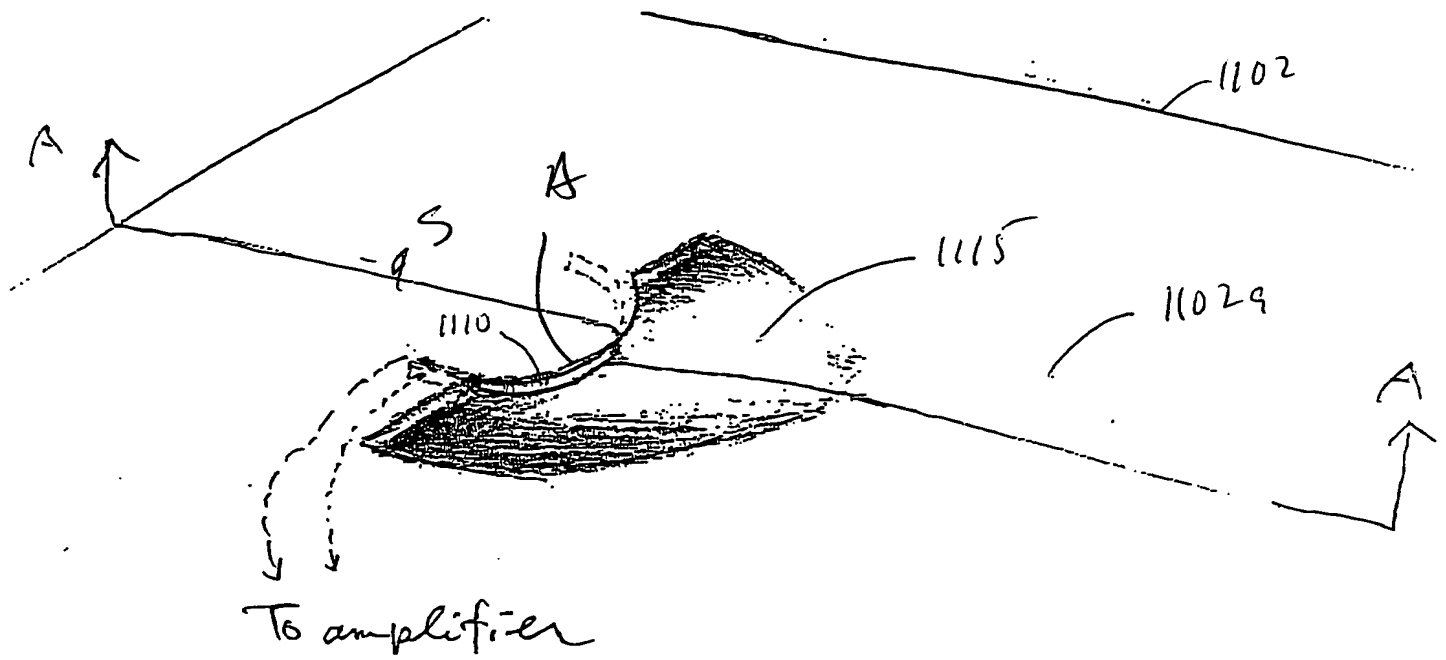


FIG. 45A

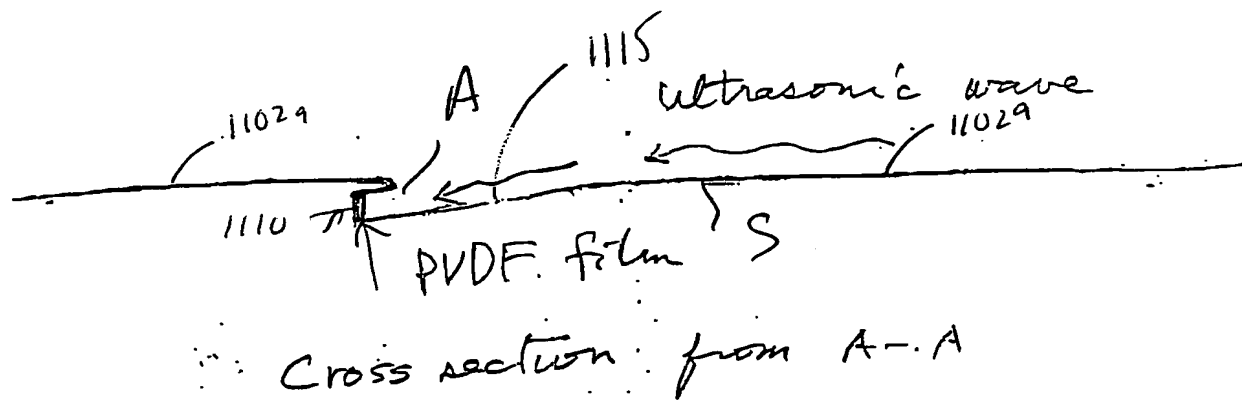


FIG. 45B

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